UNITED STATES NAVY NUTRITION CULTURE AND HOW BEST TO SELECT FOOD WHILE UNDERWAY

A thesis presented to the Faculty of the U.S. Army
Command and General Staff College in partial
fulfillment of the requirements for the
degree

MASTER OF MILITARY ART AND SCIENCE
General Studies

by

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2013-02

REPORT DOCUMENTATION PAGE			*Form Approved* *OMB No. 0704-0188*
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**			
1. REPORT DATE *(DD-MM-YYYY)* 13-12-2013	**2. REPORT TYPE** Master's Thesis		**3. DATES COVERED** *(From - To)* FEB 2013 – DEC 2013
4. TITLE AND SUBTITLE United States Navy Nutrition Culture and How Best to Select Food While Underway			**5a. CONTRACT NUMBER**
			5b. GRANT NUMBER
			5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S) Sean D. Mollahan, Lieutenant Commander, USN			**5d. PROJECT NUMBER**
			5e. TASK NUMBER
			5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Command and General Staff College ATTN: ATZL-SWD-GD Fort Leavenworth, KS 66027-2301			**8. PERFORMING ORG REPORT NUMBER**
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)			**10. SPONSOR/MONITOR'S ACRONYM(S)**
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for Public Release; Distribution is Unlimited			
13. SUPPLEMENTARY NOTES			

14. ABSTRACT

The subject of nutrition has been a point of concern across the world for centuries. Nutritionists have studied through countless ways, trying to determine how different foods affect human health. These studies have spanned many generations, nationalities, ages, and circumstances. This thesis is a look into nutrition through the eyes of a United States Navy sailor. More specifically, this sailor is underway, deployed onboard a U.S Navy aircraft carrier. This is not a look into how the U.S. Navy can change the food it serves the sailor, but rather what foods are best choices for him or her given the menu currently offered. An exploration of how the U.S. Navy prepares its foods, what guidelines they provide to its sailors on nutrition, and what those guidelines are based on provide a background for current U.S. Navy nutrition culture. This information was used to direct research towards pertinent resources, scientific literature, and studies in an attempt to gain understanding of the current stance on nutrition and health and how they are related. Finally, from lessons learned during research, three days from an approved U.S. Navy menu for deployed aircraft carriers were used for analysis. The analysis concluded that three ratios (omega-6 to omega-3 fatty acids, sodium to potassium, and sugar to net carbohydrates) could be used to select foods that generated an optimal diet considering the underway circumstances onboard U.S. Navy aircraft carriers.

15. SUBJECT TERMS

Nutrition, Navy, Menu, Galley, Deployed, Underway, Health, Fitness

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			**19b. PHONE NUMBER** *(include area code)*
(U)	(U)	(U)	(U)	102	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

UNITED STATES NAVY NUTRITION CULTURE AND HOW BEST TO SELECT FOOD WHILE UNDERWAY, by LCDR Sean Mollahan, 102 pages.

The subject of nutrition has been a point of concern across the world for centuries. Nutritionists have studied through countless ways, trying to determine how different foods affect human health. These studies have spanned many generations, nationalities, ages, and circumstances. This thesis is a look into nutrition through the eyes of a United States Navy sailor. More specifically, this sailor is underway, deployed onboard a U.S Navy aircraft carrier. This is not a look into how the U.S. Navy can change the food it serves the sailor, but rather what foods are best choices for him or her given the menu currently offered. An exploration of how the U.S. Navy prepares its foods, what guidelines they provide to its sailors on nutrition, and what those guidelines are based on provide a background for current U.S. Navy nutrition culture. This information was used to direct research towards pertinent resources, scientific literature, and studies in an attempt to gain understanding of the current stance on nutrition and health and how they are related. Finally, from lessons learned during research, three days from an approved U.S. Navy menu for deployed aircraft carriers were used for analysis. The analysis concluded that three ratios (omega-6 to omega-3 fatty acids, sodium to potassium, and sugar to net carbohydrates) could be used to select foods that generated an optimal diet considering the underway circumstances onboard U.S. Navy aircraft carriers.

ACKNOWLEDGMENTS

I would like to dedicate this thesis to all the Sailors and Marines, who are tireless in their duties each and every day, whether they are at home, deployed on land, or deployed underway. It is an honor for me to work alongside such professionals. It is my humblest hope that the lessons shared in this thesis can in some ways help enhance the quality of life of deployed Sailors and Marines through the food choices they make while underway.

I would also like to extend a huge thank you to my committee for all the help over the year. Their guidance was essential, keeping me on course throughout the process.

Finally, and most definitely not least, to my family, whose consistent love and support is immeasurable, there are no words to describe my appreciation. I am so lucky.

This has been a great project and I am very grateful to have had the opportunity to explore a subject I am so interested in.

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ACRONYMS

AHA	American Heart Association
FSM	Food Service Management
HDL	High-density Lipoprotein
HHS	United States Department of Health and Human Services
IU	International Unit
LDL	Low-density Lipoprotein
NOFFS	Navy Operational Fitness and Fueling Series
RAE	Retinol Activity Equivalents
RD	Raw Data
USDA	United States Department of Agriculture

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CHAPTER 1

INTRODUCTION

> The new defense strategy will put increased responsibilities on the Navy and Marine Corps in the years to come. You are the department's most essential asset, and it is the duty of the department's leadership to do all we can to provide each individual Sailor and Marine with the resources to maintain that resiliency.
>
> — Ray Mabus, Navy.mil

Overview

The Secretary of the Navy presented the above quote on March 5, 2012 on board the USS Bataan, which was part of a worldwide “All Hands Call” to the Department of the Navy. It announced the beginning of a new focus in the department called the 21st Century Sailor and Marine Initiative. This initiative, as the quote suggests, sets to provide the Department of the Navy with the tools needed to answer future challenges the sailors and the marines will face both mentally and physically. The initiative focuses on five areas: Readiness, Safety, Physical Fitness, Inclusion, and Continuum of Service (Secretary of the Navy Public Affairs 2012). For the sake of this research, the area of Physical Fitness will be highlighted and more specifically nutritional choices of underway sailors.

The Physical Fitness area of the Initiative has a few goals it sets out to achieve. On the 21st Century Sailor and Marine website, it states one such goal is to “improve nutrition standards at our dining facilities with the introduction of the ‘Fueled to Fight’ nutrition program ensuring that healthy food items are available at every meal” (U.S. Navy 2013). The intention of this thesis is to examine the current condition of galley

meals for sailors underway onboard United States Navy aircraft carriers and how best for them to make choices which will enhance their overall wellness.

An underway ship has conditions that limit the type, quality, and amount of food that can be provided to the sailors of her crew. The circumstances for each ship are unique and every deployment has a different mission. It is not uncommon to have ships deployed for six months or more without ever pulling into a port. In those instances, a ship must rely solely on underway replenishments (UNREPs) for food and supplies. When submarines deploy, they can stay underwater for days, weeks, or months at a time. The food and supplies loaded upon departure from their homeport is all they have. These limitations affect the nutritional options available to the sailor, which makes it even more important for them to select wisely from the food provided. This concern is what this research intends to address.

History of Navy Nutrition

Napoleon said an army "marches on its stomach" (Gratzer 2005, 107). The same is true for sailors. The importance of sustenance is obvious, you feed the crew or they die. However, the importance of nutrition became exceedingly evident as navigation advanced, nautical knowledge expanded, and seafaring vessels improved, which allowed voyages to grow longer. Food rations the ship provided resulted in a ship's crew being a healthy, effective crew or a sick, ineffective one. The history of nutrition in the world's navies began with that big problem and without an understanding how to fix it.

The first circumstance often mentioned in regards to navy nutrition is the battle against scurvy. The world's navies noticed that voyages lasting for at least 10 weeks resulted in a majority of the crew coming down with scurvy (Carpenter 2012, 259). James

Lind, a Royal Navy ship's surgeon on board the HMS *Salisbury* in 1746 (Gratzer 2005, 21), utilized one bad case of scurvy to conduct, what is credited as, the first clinical nutritional trial (Carpenter 2012, 260). The diet of sailors at this time consisted of salted fish and meat, dried vegetables, biscuits, cheese, butter, and beer, wine, or rum. The estimated caloric intake was between 2500 and 3000 calories (Cuppage 1995, 696). Lind conducted his experiment with different groups on the ship to test different remedies believed to cure the scurvy symptoms. The group consuming citrus juices was cured. Lind concluded that something in the lemons and oranges had to be the reason for their recovery. While Lind's conclusion as to why citrus juice was helpful was later disproved, his clinical trial would eventually lead to the discovery of vitamin C some years later. Unfortunately, the disease would claim over 2 million sailors (Carpenter 2012, 264) before the scientist would discover the vitamin.

The understanding of vitamin C is not the navy's only nutritional contribution to the world. The French Navy in the 1860s complained of rancid butter on long journeys and requested a cheap replacement. In 1869, a French food chemist named Hippolyte Mege-Mouries patented a method for the creation of margarine (Gratzer 2005, 105). Later, Napoleon understood the importance of fresh food for soldiers or sailors, the Revolutionary regime offered a reward in 1795 of 12,000 francs to anyone who could come up with a method to preserve fresh food. That reward was eventually paid out to Nicholas Appert. He created a method of heating food in a closed vessel, pouring it into a glass jar and sealing it. This method became known as appertization. The thinking behind this method was based on the belief that air was what rotted food. The French Navy first tested the preserved food successfully on a four-month cruise, which inspired Bryan

Donkin and John Hall to create a way to preserve food in tin cans for the Royal Navy (Gratzer 2005, 107).

Around this time, the young U.S. Navy was benefitting from discoveries and innovations from across the Atlantic Ocean; however, U.S. sailors' diets on board ship remained the same as a century before. Bread was the staple of the meal along with salted beef, salted pork, and grog. Grog was historically rum in the American Navy, though the Navy Department started to introduce whiskey in 1806 (Fisher and Fisher 2011, 29). The food provided in the U.S. Navy remained relatively the same for the rest of the 19th century.

In 1902, the U.S. Navy published its first cookbook for ship's cooks and crew. In addition, recruiters started to get requirements to fill quotas for food service candidates in jobs such as cook, baker, or commissaryman (Fisher and Fisher 2011, 135). These new culinary recruits received special training that used U.S. Navy cookbooks as textbooks and took them to their first ships. Eventually cookbooks became a fixture in the galley kitchens across the U.S. Navy fleet and helped to enhance variety in ships' menus. Periodically the U.S. Navy updated the text and it gives good insight into the nutritional ideas of the U.S. Navy at different times in its history.

There is not much mention of nutrition in the early editions of the cookbooks. They were mostly a collection of recipes and preparation instructions. In the 1920 book, nutrition is mentioned but only in ways concerning cooking food properly so that it was safe for consumption and easy to eat (United States 1920, 5). Later editions became a little more specific concerning the subject of nutrition. The 1932 edition, while still vague, addressed the importance of various foods and the use of "protective foods" which

included butter, milk, eggs, leafy vegetables and greens, and fresh fruits and vegetables. Experts at the time believed these “protective foods” prevented certain diseases (United States 1932, 167). Page one of the 1944 U.S. Navy cookbook starts with a whole section devoted to food nutrition. In this section, the book explains that the four parts of a diet are “protein, vitamins, minerals, and energy producing factors” (United States 1944, 1). Accordingly, a balanced diet in 1944 consisted of 3000 to 4500 calories, 10 to 15 percent of calories from protein, 55 to 70 percent from carbohydrates, and 20 to 30 percent from fat (United States 1944, 3). These cookbooks slowly phased out as different training publications, like *Planning Navy Meals* or *Foodservice Operations*, took their place.

U.S. Navy nutritional guidelines continued to evolve, becoming more sophisticated, as knowledge of food nutrients increased. Also, inventions such as dishwashers, refrigerators, ice cream machines, and other appliances were being incorporated in the ships’ galley as soon as practical to enhance the galley crew’s capability and function. The addition of nutritional knowledge and innovations enabled the expansion of supplies carried on ships and, therefore, increased food variety.

World War II proved to be an exercise in extreme logistics to provide Navy crews with food. Spread across the Pacific and Atlantic oceans, the Fleet required an increase in refrigeration ships, but some ships did continue to receive less than required provisions (Fisher and Fisher 2011, 169). Logs reviewed from some submarines noted that in times of limited food, the crew appreciated the vitamin packs and its prevention of avitamosis (United States Navy Department Bureau of Medicine and Surgery 1950, 50). This circumstance goes to show the gained knowledge from the U.S. Navy in minimum requirements to maintain working health.

Congressional policy has always mandated the U.S. Navy food provisions. Those policies shaped the diet of the U.S. Navy sailor throughout its history. In 1943, when the Food and Nutrition Board published the first recommended dietary allowances (United States 1968, 75), the U.S. Navy had a set of tables with which it used to base its nutritional goals. Since then, some independent research for U.S. military nutrition has been done, the U.S. Navy's nutritional goals and education to its sailors has been very similar, if not exact, to the guidelines to the general public.

Changing general public guidelines have resulted in the U.S. Navy's definition of a well-balanced meal to change over time as well. In 1944, the recommended caloric range was between 3000 and 4500 calories, no differences given for age, weight, or gender, with protein taking 10 to 15 percent, carbohydrates taking up 55 to 70 percent, and fat taking 20 to 30 percent of total calories consumed (United States 1944, 3). In 1958, the recommendation for males, 25 year old, weighing 154 pounds, was 3200 calories and protein down to 8.75 percent of total calories or 70 grams (United States 1958, 30). A 25 year old male in 1968, still weighing 154 pounds was suggested to eat 2900 calories with 9.65 percent of calories coming from protein (United States 1968, 75). Those changes continued as the recommended daily dietary allowances were changed by the Food and Nutrition Board.

Ultimately, the other Armed Services follow similar recommended daily allowance guidelines agreed on by the Department of Defense. Therefore, in 1968, the Armed Services consolidated recipes for all the services through the Armed Forces Recipe Service (United States 1968, 81). After this consolidation, all services began preparing meals from the same recipes, as ingredients were available.

There have been major changes in the U.S. Navy's nutrition over the course of its history. Starting in the infancy of the nation, a sailor's diet consisted of mostly bread, salted meats, and grog supplemented with small amounts of fruits or vegetable as replenished in ports to the extensively researched and developed 21-day cycle meals of today. In 1951, the 1933 Congressional ration law was changed making a food ration a monetary value instead of a quantity of food (Fisher and Fisher 2011, 204). Even the individual ratings of the people that cook the food changed "from cook (1797), to ship's cook (1838) to commissaryman (1948) to mess management specialist (1975) and as of January 2006–culinary specialist" (Fisher and Fisher 2011, 218). Changes will continue as the U.S. Navy tries to provide food in line with governmental guidelines to its sailors under the constraints of life at sea.

Current U.S. Navy Nutrition Initiatives

The Secretary of the Navy's establishment of the 21st Century Sailor and Marine Initiative on March 5, 2012 is the most recent large-scale change to the U.S. Navy's nutritional focus. The initiative focuses on five areas of the sailor or marine's life to promote overall wellness. One area, Physical Fitness, emphasizes the importance of lifestyle and nutritional choices of sailors and marines. As a result, the U.S. Navy established the "Fueled to Fight" nutritional program to meet requirements of the 21st Century Sailor and Marine initiative (U.S. Navy 2013). The program encompasses a collection of U.S. Navy nutritional programs and tools to enhance the fleet's health.

Office of the Chief of Naval Operations (OPNAV) N170 is the office inside the Navy Personnel Command, which is responsible for the policy of the U.S. Navy nutritional programs. Its vision is "to create a Navy environment that supports the

healthful choice as the easy choice and empowers individuals to make informed choices about their nutrition" (Navy Personnel Command 2013). In maintaining that vision, it is committed to ensuring the U.S. Navy programs and initiatives align with higher guidance. The current programs the office uses as guidance are Operation Live Well, 21st Century Sailor and Marine, and National Prevention Strategy-DOD Commitments.

All three of these wellness programs are very similar but written for different audiences. The National Prevention Strategy-DOD Commitments, generated by the Surgeon General's office, is directed to the whole nation and its lawmakers. The Operation Live Well program has a more focused audience, the U.S. Department of Defense. The 21st Century Sailor and Marine Initiative is addressed to the Department of the Navy. All written and designed for different groups, the nutrition and the themes behind each program are the same. All of these directives aim to educate healthy choices and provide simple and accessible healthy options to their members.

The U.S. Navy has established a number of programs to educate its sailors and marines about nutrition. These programs, established through the policies of the N170 office, have a wide reach across the U.S. Navy. Some of the programs, under the umbrella of "Fueled to Fight," include:

Shipshape

This is a health-promoting program targeted for individuals who test outside body composition standards with education on nutrition, lifestyle choices, and other topics. The program includes an hour session per week in a group atmosphere for a determined amount of time (Navy Personnel Command 2011).

Mission Nutrition

This is a nutrition education program setup through Marine, Wellness, and Relief (MWR) Fitness Centers on U.S. Navy installations for sailors, their family members, and retirees (Navy Personnel Command 2011).

Registered Dieticians

The U.S. Navy does provide registered dieticians throughout its fleet. This is done on a case-by-case basis and a locating service is proved thorough the Navy Personnel Command website (Navy Personnel Command 2011).

Navy Operational Fitness and Fueling Series (NOFFS)

This program was established in 2010 in coordination with Athletes' Performance Institute (API). Its goal is to provide sailors with "world-class" performance training resources and tools to exercise smartly and make healthy food choices (Commander Navy Installations Command 2013b).

Galley Go Green

"Galley Go Green" is a program created to simplify food choices for sailors at shore-based galleys by using color codes; green, yellow, or red. Colors are determined by on the nutritional value of the food based on calories, total fat, cholesterol, and sodium (Navy Personnel Command 2011).

These programs focus primarily on education and providing tools for the sailor. Actual food choices and menus provided onboard ships while in port or out at sea, are the responsibility of the Navy Supply Systems Command (NAVSUP). Under their command is the Navy Food Management Team (NFMT), which provides oversight for how food is

prepared and provided in ships' galleys. In association with NAVSUP is Food Service Management (FSM), which is the vehicle used to disseminate menus and food preparations for culinary specialists (CS) onboard Navy vessels. FSM gives the galley crew the most recently approved menu list, preparation, and nutritional information (Moore 2012, 5). For U.S. Navy aircraft carriers there is an approved 21-day meal cycle provided on the FSM system. Ships have the option to change a menu if desired; however, the ship's commanding officer and the Navy's nutritionists must first approve the change before it is used. This research will only reference the approved 21-day meal cycle for deployed aircraft carriers as its meal cycle for food choices.

Primary Research Question

Using the 21-day cycle menu for U.S. Navy aircraft carriers underway last updated April 2013, what food choices should a 23 to 25 year old sailor make to gain maximum health benefits from his or her meals?

Secondary Research Questions

What is(are) the optimal diet(s) to promote health and overall well-being?

What nutritional information is the U.S. Navy currently providing its sailors?

What is the nutritional information based upon?

Assumptions

The following are a few assumptions that this thesis made throughout this research process. In order to analyze caloric requirements for an underway sailor, a male sailor will be defined as 70 inches tall, weighing 170 pounds, 25 years of age and a female sailor as 65 inches tall, weighing 145 pounds, 23 years of age. In addition, as

observed underway, workdays averaged between 10 to 13 hours with a moderate to active caloric expenditure rate depending on jobs. Furthermore, this study will only consider the U.S. Navy's general 21-day meal cycle for underway aircraft carriers as of April 2013. Every ship is slightly different in how food is prepared and what could be available, so considering only one meal cycle will be the base line.

Limitations

Changing trends and ongoing research make investigating the topic of nutrition challenging. Therefore, due to the time allotted for this project valuable resources may be missed. Also, time ultimately limited research on foods provided by the generic approved 21-day meal cycle for deployed aircraft carriers. General conclusions will be applicable to other menus and instances. However, choosing only one menu allows for more comprehensive analysis and specific menu item recommendations for the days looked at. It should also be noted that since the food will not be tested specifically for this project, all data used throughout this thesis will be based on nutritional information provided to U.S. Navy sailors on menu items, as well as, using published ingredients from recipes and inputting them into a food tracking program such as Nutrition Data at www.nutritondata.com. This, again, is another instance were conclusions drawn will only be good as the information found and provided. Finally, while I am extremely interested in the subject matter I am not a licensed or professional nutritionist or dietician. My opinions and discoveries on this subject will be based solely on professional material found and are in no way medical recommendations. As with any other diet related discussion, all changes in diet should be discussed with a licensed medical physician before implementing.

Significance of the Study

I hope the research I do over the course of the year will be able to improve the lives of sailors at sea and elsewhere. During my last tour, I realized how the food I chose while underway and what the galley offered completely affected my overall psyche. I want to provide sailors, or anyone in a similar cafeteria like setting, with a better understanding of the nutritional value of food. In addition, I have no personal agenda or bias concerning one specific diet. My objective is to find the most optimal diet for sailors and what choices they can make underway to increase overall health.

CHAPTER 2

LITERATURE REVIEW

Sailors and marines who deploy onboard United States Navy war ships live under unique circumstances. Their home is a floating island confined by the hull of the ship and void any roads or direct connections to dry land. The inherent problem in this situation is how to feed and provide ideal nutrition to crews during those long voyages across large bodies of water. The problems of food, and especially nutrition, became evident in early world navies as ships and crews sailed for longer and longer periods between port calls. Today, those concerns persist and efforts continually try to address them. U.S. Secretary of the Navy Ray Mabus announced the most recent effort in 2012. In an address to the entire U.S. Department of the Navy, Secretary Mabus described the department's new focus on health through a program called the 21st Century Sailor and Marine Initiative. The goals of this initiative are to improve the overall wellness of sailors and marines through education and by providing opportunities for healthy choices.

This chapter, the literature review, will summarize findings in various applicable publications that cover the ideas of nutrition, nutrients, and health. One of the five pillars of the 21st Century Sailor and Marine Initiative is physical fitness, which includes diet and nutrition. So the question becomes, what must the sailor or marine choose while underway to enable him or her to maintain the most nutritious diet given the food provided? Since the 21st Century Sailor and Marine Initiative was announced, the talk of "a culture of physical readiness" (U.S. Navy 2013) has increased, as have nutritional tools, resources, and education. Investigating the nutritional guidance of the U.S. Navy, its menus, programs, and additional resources suggested outside of its purview, as well as

relevant nutritional research in nutrients, diets, and health, will give a foundation to answer the question of best choices for an underway sailor or marine.

Current U.S. Navy Nutritional Guidance

The current U.S. Navy menu has evolved from its humblest beginnings of bread, salted meats, and grog to an elaborate 21-day cycle. This section will discuss how the U.S. Navy creates its menus and what U.S Navy nutritional guidance it recommends through programs, tools, and suggested additional resources.

Meal Planning

As previously discussed, life onboard a ship is an unnatural experience. Every piece of life is restricted to what is available onboard the vessel. In the case of a deployed U.S. aircraft carrier, up to 6000 people spend their days depending on supplies and services available onboard. This means the personnel in the food services division are an extremely important group of people. It is their job to provide food for the ship's crew, which runs 24 hours a day, 7 days a week. Looking into how they accomplish this can provide an idea of how the U.S. Navy sees food and nutrition.

The *Food Service Operation Handbook* provides the food service division with guidelines and suggestions into how to develop and implement a menu cycle. The Navy Supply System Command published the most current version reviewed for this project in January 2010. The first chapter titled "Nutrition and Menu Planning" explains requirements and important considerations to have when planning a menu cycle for the crew (Navy Supply System Command 2010, 1-1). There are pre-approved menu cycles for different ship types that may be used. However, menus can be generated from scratch

and approved annually by Navy Supply Command dieticians (Navy Supply System Command 2010, 1-15). The Food Services Division makes that decision on each ship. For ease of analysis, this thesis will consider a pre-approved 21-day menu cycle for deployed U.S. Navy aircraft carriers, but the rationale behind creating a menu will aid in understanding the role of food in the U.S. Navy.

Since the ship's crew works throughout the day, Food Services is required to plan four meals: breakfast, lunch, dinner, and midnight rations or MIDRATS (for those personnel working night shift hours). Each meal has a specified time the galley crew serves food that lasts for about two to three hours per meal. The defined meal times means those hours are precious and the ability to get food between the meal schedule is limited. The food ration for each sailor is calculated for three meals a day.

The *Food Service Operation Handbook* explains a few main themes in the first chapter. One, variety is an important characteristic of an acceptable menu cycle. The handbook encourages using tools to ensure variety exists. A "meat block," for example, is a frequency chart tracker for planning and rotating between different meat types (Navy Supply System Command 2010, 1-16). Secondly, the menu is required to provide sailors with healthy options for most meals. The rule is if two or more entrees are served then one healthy option meal must be provided. In the case of an aircraft carrier, because the crew is so large, meals usually consist of at least two entrées; therefore, each meal will have a healthy option available. This handbook defines healthy options as being: Entrée–15 grams of fat or less, Side (starch or vegetable)–5 grams of fat or less, and Dessert–5 grams of fat or less (Navy Supply System Command 2010, 1-17). Finally, the handbook encourages the staff to display nutritional data placards for each food item, have healthy

options labeled, and provide a sample healthy meal display visible to the crew. The nutritional data provided for menu items are portion size, calories, carbohydrates, protein, fat, percent of calories from fat, dietary cholesterol, sodium, and calcium. This handbook goes into further detail on each theme, but this paragraph summarizes the overall message.

The galley staff has a difficult task providing food for a hungry crew every single day over a long deployment. Guides, such as the *Food Service Operation Handbook*, give the staff a base of information in order to provide a variety of options for the ship's crew. The U.S. Navy also provides information and resources to the ship's crew in the hopes that they will be able to make smart decisions in the food line. A look into what the U.S. Navy provides is next.

Nutrition

In the spirit of the 21st Century Sailor and Marine Initiative, the U.S. Navy provides different programs, resources, and information to its sailors. Some of those programs were introduced in the first chapter. A couple of them, NOFFS and Galley Go Green, will be explained in more detail, specifically focused on their purpose, nutritional guidance, prevalence in the fleet, and usefulness. In addition, this section will mention external resources the U.S. Navy encourages its members review for further nutritional information.

The U.S. Navy first introduced the NOFFS program to the fleet in June 2010, but its relevancy has increased since the 21st Century Sailor and Marine Initiative. Every U.S. Navy nutritional or fitness website reviewed for this thesis referenced NOFFS information and nutritional guidance. Its basic idea on food and nutrition from its fueling

series is made up of five basic themes: eat clean, eat often, hydrate, recover, and mindset (Commander Navy Installations Command 2013b).

The themes of the NOFFS fueling series aim to guide sailors to think of food as fuel, consume small meals six times a day, and consume foods as minimally processed as possible. A concept called the 80/20 rule recommends eating nutritious foods 80 percent of the time and foods you want 20 percent of the time. The idea is the nutritious foods eaten 80 percent of the time will strengthen and recover the body, while the other 20 percent prevents the diet from becoming undesirable or boring. Also, as part of the fueling program, NOFFS created a virtual meal builder, which uses the sailor's gender, current weight, and fitness goals to generate a meal plan. The meal builder suggests servings for grains, protein/dairy, fruits, vegetables, fats, and calories for each of the six eating times per day (Commander Navy Installations Command 2013b). All these tools are available through the navyfitness.org website, as well as an application form for smartphones, thus making this information accessible to sailors.

Galley Go Green, using principles based on the Department of Defense's Go For Green program, is another program the U.S. Navy uses to compliment the 21st Century Sailor and Marine Initiative. Currently, this program is established at most of the Fleet's land-based galleys. However, it is has begun making its way out to sea. Recently, March 2013, the USS Ronald Regan (CVN 76) launched Galley Go Green onboard (Walton 2013). This launch is evidence, as recommended by the *Food Service Operational Handbook*, that some shipboard galleys are getting more proactive with their food labeling methods.

Galley Go Green’s concept is quite simple. Every food served in the galley is labeled with either a green, yellow, or red placard based on Galley Go Green nutritional guidelines. The placards, which have been providing some nutritional information of food items, are now colored to give sailors an idea what the Galley Go Green program deems are healthy options at a glance. As an example, though menu item exceptions do exist in the program, table 1 shows the basic criteria for a single entrée item.

Table 1. Entrée Criteria–Go For Green (TM) Program

Green	Yellow	Red
< 300 calories	300-500 calories	> 500 calories
< 10 grams fat	10-15 grams fat	> 15 grams fat
< 480 milligrams sodium	480-700 milligrams sodium	> 700 milligrams sodium

Source: Navy Personnel Command, *Go For Green (TM) Program*, http://www.public.navy.mil/bupers-npc/support/navynutrition/Documents/Program%20 Criteria-g4g-revisedNAHPWG%20-10-24-2012.pdf (accessed July 29, 2013), 1.

From the criteria in table 1, this program emphasizes calories, fat, and sodium as determining the nutritional value of a food. The program has specific criteria for different food types such as full dish, starchy sides, vegetables, desserts, beverages, and dairy. Therefore, though there are some food exceptions, by following the basic advice of this program one would be avoiding high fat, high energy, and high sodium foods.

These two programs along with additional U.S. Navy sponsored nutritional advice were found at navyfitness.org. For each one of the resources available on this website the

same notification appears that the information provided “is based on recommendations of the American Heart Association, National Heart, Lung and Blood Institute, Department of Health and Human Services, US Department of Agriculture, Food and Drug Administration and the National Institute of Health” (Commander Navy Installations Command 2013a). These institutions provide the foundation for Navy nutritional educational programs, suggestions, and meal plans. Therefore, it is clear that research into the information provided by each group is necessary.

Suggested External Nutritional Resources

As previously discussed, the U.S. Navy provides many different nutritional resources to its sailors to educate and improve their health. However, most of the guides are short, designed to be read quickly, and applied right away. For a more in depth understanding on diet and nutrition the U.S. Navy recommends publications from the organizations it bases its nutritional guidance on. Those resources are generated by the American Heart Association (AHA), National Heart, Lung, and Blood Institute, Department of Health and Human Services (HHS), U.S. Department of Agriculture (USDA), Food and Drug Administration, and National Institute of Health. A little background for these organizations is prudent since they have different audiences and goals.

The HHS, whose role as a department of the United States’ government is to ensure the health of the citizens of the United States, houses three of the five organizations mentioned. The Food and Drug Administration and the National Institute of Health are both agencies within the HHS (U.S. Department of Health and Human Services 2013). In addition, the National Heart, Lung, and Blood Institute is an office

within the National Institute of Health. Although their focuses and goals are somewhat different, ultimately their nutritional guidance is the same.

Next, the AHA is a voluntary organization first founded in 1924. Six cardiologists began this organization in order to combat the threats of cardiovascular disease and stroke. Over the years, the organization has grown tremendously with more than 22.5 million volunteers. It is considered by many as one of the premier authorities on healthy lifestyle choices. The AHA promotes those choices through education and by providing resources to the public in the fight against cardiovascular disease and stroke (American Heart Association 2013a).

Finally, the USDA was created to support the rural and farming Americans. Since its creation, its role has continued to expand as the country has changed and grown. Currently, the department’s mission statement establishes that it does not only support the farms and rural areas but also food sustainment, nutritional education, and nutritional recommendations (U.S. Department of Agriculture 2013).

Since each one of these organizations has been a large part of the national and U.S. Navy’s nutritional recommendations over the years, an examination of their current guidance will be helpful. This exploration begins with the AHA. The most recent article from the AHA states that “a healthy diet and lifestyle are your best weapons to fight cardiovascular disease” (American Heart Association 2013b). In order to accomplish this, the association offers a few basic things to do and not do for the reader. The AHA suggests eating only the calories required by your body to function, taking into account activity level and exercise, is needed to maintain optimal body weight. Also, a variety of healthy foods, defined as vegetables, fruits, unrefined whole-grains, and fish, should be

the goal of anyone trying to improve their diet. The foods and items to avoid or limit are those containing saturated fats, trans fats, dietary cholesterol (no more than 300 milligrams per day), sugary foods and drinks, and sodium (less than 1500 milligrams per day) (American Heart Association 2013b). This type of diet coupled with a healthy lifestyle, according to their studies, will greatly reduce heart disease risk.

The USDA and HHS nutritional guidance will be discussed together. This is done because since 1980, these two departments have collaborated every five years in publishing the *Dietary Guidelines for Americans*. The 2010 version, the seventh edition in the series, is the most recent publication and considered current until the release of the 2015 guidelines. The goal of this publication is to provide guidance on diet for Americans for ages two and older to enable weight maintenance, promote health, and prevent disease (U.S. Department of Agriculture 2010). The document is quite extensive and established through a panel of nutritional experts who analyze current nutritional research to determine if evidence is strong, moderate, or limited for the recommendations they make.

A review of the *Dietary Guidelines for Americans, 2010* provides a very descriptive understanding concerning the nutritional guidance from both the USDA and HHS. They prominently display their key recommendations at the beginning of the document. They recommend Americans reduce sodium intake, consume less than 10 percent of calories from saturated fat and less than 300 milligrams of dietary cholesterol, 0 grams of trans fat, and less added sugars (U.S. Department of Agriculture 2010, x). While these are some suggested limitations, the foods to increase are fruits, vegetables, whole-grains, low or no fat dairy products, lean meats, especially seafood, and foods high

in potassium, fiber, calcium, and vitamin D (U.S. Department of Agriculture 2010, xi). A diet rich in their healthy foods and absent the unhealthy, according to their determination, will reduce the risk of diet related disease, including heart disease, hypertension, diabetes, certain cancers, and osteoporosis (U.S. Department of Agriculture 2010, 3). Just as stated by the AHA, calories in must equal calories out to balance a person's weight and this publication finds there is strong evidence proving there is not an optimal macronutrient (carbohydrate, protein, fat) ratio for weight loss. However, they do reference the Institute of Medicine for a macronutrient ratio in percent of calories consumed as a recommended diet: Carbohydrates–45 to 65 percent, Protein–10 to 35 percent, and Fat–20 to 35 percent (U.S. Department of Agriculture 2010, 15). The document further describes, discusses, and displays additional nutritional evidence, information, graphs, and tools to use.

It is clear why the U.S. Navy directs its sailors to review the resources from the AHA, HHS, and USDA for further nutrition explanations. These three revered organizations have very similar recommendations and are closely align with the teachings of U.S. Navy nutritional programs. However, although all these organizations agree in broad terms with what makes a nutritional diet, there is still room for interpretation. For instance, throughout the *Dietary Guidelines for Americans, 2010* there are recommendations made, self-admittedly, without strong evidence for support. Therefore, a study of current scientific nutritional research might give a better description of what specific food choices sailors should make while deployed to improve their diet and health in that underway environment.

Nutritional Research

The initial literature reviewed was concerned with the U.S. Navy's general nutritional guidelines and the programs it has for its sailors. Next, this chapter explored where that information came from. With that understanding complete, it is time to look at some of the current nutritional research and clinical studies. As discussed previously, the organizations the U.S. Navy uses to base its nutritional guidelines have a long history of leading the nation in healthy lifestyle choices and nutritional education. However, their broad recommendations require some refinement if specific healthy menu choice guidelines are going to be provided to sailors according to their underway menu. Current nutritional research and clinical trials can give a better understanding of how and why nutrition and different nutrients affect health.

Nutritional research is an extremely broad term, so in order to begin the process five mainstream food and nutrition based books were used as a starting point in the exploration. Each book takes a look at nutrition and diet from different perspectives and arrives at various conclusions. The five books are: *In Defense of Food: An Eater's Manifesto* by Michael Pollan, *Good Calories, Bad Calories* by Gary Taubes, *Perfect Health Diet* by Paul Jaminet, Shou-Ching Jaminet, and Mark Sisson, *The Wheat Belly* by William Davis, and *The China Study* by T. Colin Campbell. These five books began the thesis's research after understanding of the U.S. Navy's guidelines and resources was complete. A very brief explanation of the conclusions of each these books is listed next, but more specific data from those sources will be used throughout.

The book, *In Defense of Food: An Eater's Manifesto* by Michael Pollan, makes a basic conclusion that can be best summarized from his introduction, "Eat food. Not too

much. Mostly plants" (Pollan 2008, 1). He expounds on this quote throughout his book. By it, Michael Pollan means that a majority of the foods eaten today are food like substances and not true food. He argues that the procedure to process many of the foods eaten currently have ripped any nutritional value from its original state. Therefore, he states eating food as close to its natural state is the goal and most beneficial (Pollan 2008).

Good Calories, Bad Calories by Gary Taubes takes on the premise that not all calories are created equal because the body processes them differently. From his research, he concludes dietary fat is not the cause of obesity or chronic disease, but carbohydrate overconsumption is the concern (Taubes 2007, 9078), and consuming a nutrient rich diet is more important than cutting calories (Taubes 2007, 9127).

Perfect Health Diet was actually a book suggested by a healthcare provider who said he was not supposed to share his liking of the book because his employer was required to advise a diet similar to the U.S. Navy, USDA, and HHS recommendations. The basic conclusion from this book was somewhat similar to the *Good Calorie, Bad Calorie* book except for one big difference. The *Perfect Health Diet* concluded from their research that there was a carbohydrate minimum requirement (Jaminet, Jaminet, and Sisson 2012, 230), where *Good Calorie, Bad Calorie* left the possibility open for there not to be one (Taubes 2007, 9103). The *Perfect Health Diet* concluded fat not to be an issue and that consumption of vital nutrients was important. However, some of the nutrient requirements discussed in the book are different from current recommendations by U.S. Dietary Guidelines, some being higher and some being lower. This book does

quote Michael Pollan’s conclusions discussed previously, concerning eating real food, and mostly agrees.

The *Wheat Belly* by William Davis, as the title suggests, discusses wheat and concludes that wheat has an overall negative impact on health. A lot of what he discusses on wheat is about how much it has genetically changed since harvesting it first began. The change in wheat has accelerated to an unnatural level in “the past fifty years under the influence of agricultural scientists” (Davis 2011, 38). The changes to wheat have amplified, in his estimation, its negative effects on health and nutrition. While he does not exclude high carbohydrate intake as a problem, he does conclude that all wheat derived carbohydrates, whether refined or whole-grain, are most responsible for the increase in diet related illnesses.

As can be seen, these previous four books were very close in their basic conclusion. In short, they conclude high carbohydrate diets are a big problem for nutrition and health. Many of the first four books described have no issues with fat, even saturated fat, or protein. So another perspective needed to be reviewed before diving into current research, therefore, a work cited in many articles, documentaries, and books was used. The final book used as a preliminary resource was *The China Study* by T. Colin Thompson. He was the director of the China Study that began in 1983 and wrote this book in 2006. The book reports on that study and explains what he and his team concluded from the findings. The study examined health and nutritional data records collected from across 170 Chinese villages over a period of decades (Campbell and Campbell 2006, 67). This often cited study concluded that areas where animal protein consumption was highest seemed to show evidence of having the poorest health as

measured by longevity, cancer, and disease rates. Therefore, the study's diet suggestion is summed up like this: "eat whole foods, plant-based diet, while minimizing the consumption of refined foods, added salt and added fats" (Campbell and Campbell 2006, 451).

These five books were preliminary resources and starting points for the next part of the research for this thesis. It is already evident that there are different conclusions that can be drawn on the same questions. With some conflicting views and ideas, current research will be looked at in order to better inform sailors on the most appropriate food choices for their goals and overall health in the underway environment. In order to do that, individual nutrients will be researched by focusing on nutrients provided on nutrition placards displayed for sailors from their 21-day cycle menu items: Carbohydrates, Protein, Fat, Cholesterol, Sodium, and Calcium.

Carbohydrates

Carbohydrates were a major point of emphasis in many of the preliminary sources for this thesis. Most of those sources associated high carbohydrate intake with some negative impact on a person's health, which included increase risk of obesity, diabetes, and heart attacks. The average American eats a diet consisting of a carbohydrate level (52 percent of calories) that some of those sources claim to be unhealthy (Jaminet, Jaminet, and Sisson 2012, 151). So the questions become: What are carbohydrates? How does the body process them? Good? Bad? What are some suggested healthy ranges?

There are basically two kinds of carbohydrates, starches and sugars, and the body deals with each of these a little bit differently as only glucose is usable in the body. Starches are the easiest to explain. The digestive system breaks starches down into the

usable glucose form; that is it. On the other hand, dietary sugars are not as simple because they come in a variety of forms, so those that are not consumed as glucose must be converted. The most commonly added sugars in foods are sucrose or high-fructose corn syrup and they will be looked at here. Sucrose is half glucose and half fructose and high fructose corn syrup is 45 percent glucose and 55 percent fructose. The liver must convert the fructose from those sweeteners before use. When all is transformed, the glucose runs through the blood and is used for bodily functions such as energy now, future energy stored as glycogen (linked together glucose in the muscles), brain and nerve function, mucus production, joint lubrication, and others. The body does produce its own glucose when required from fat stores or protein, further emphasizing the importance of glucose in the body (Jaminet, Jaminet, and Sisson 2012, 193-219).

A good thing can turn bad when levels of carbohydrate intake exceed necessity. One study found a negative association with excessive sugar, especially refined sugars such as sucrose and high-fructose corn syrup, to be an increase in triglycerides, small low-density lipoproteins (LDL), and lower in high-density lipoproteins (HDL) (Siri-Tarino et al. 2010b, 502). (For cholesterol readings, most medical experts classify LDL as “bad” and HDL as “good”). Others consistently quote this negative association when discussing reasons to reduce carbohydrate intake. Also, a high fructose diet is linked to “high insulin levels, high blood sugar, and insulin resistance” (Taubes 2007, 200). These conditions over time will increase the chance of type 2 diabetes. Sugars are not bad by themselves, but there is evidence that at high levels they can become harmful. Furthermore, when fructose far exceeds glucose in the overall sugar consumption, 65 percent fructose and 35 percent glucose in one study, there is evidence of a person’s

appetite fulfillment is suppressed and food intake increases (Akhavan and Anderson 2007, 1354-1363). Result like these have resulted in high fructose corn syrup receiving such negative press because of its higher fructose content and increased use since its 1970s introduction. However, the fact that today Americans average 22.7 teaspoons a day of added sugar (the AHA recommends a daily limit of 9 teaspoons for men and 6 teaspoons for women) is probably the more important issue to consider first (Cohen 2013, 79-97), followed by high fructose consumption next. Therefore, considerations need to be made in one's diet to reduce the amount of added sugar if that diet is going to be healthy.

Why are these studies showing a link between excessive carbohydrates and negative health data? The answer to the question is how the body responds when the vital glucose in the blood reaches levels higher than it needs to carry out bodily functions. The glucose level of the blood increases as carbohydrates are consumed, thus, transporting digested food energy throughout the system. As with many things, the body closely monitors glucose in the blood and regulates the amount since extreme levels, known as hyperglycemia, can be harmful (Jaminet, Jaminet, and Sisson 2012, 126). As glucose floods the blood, the body releases insulin, a hormone produced in the pancreas, which one of its jobs is to take the glucose in the blood and make it absorbable for the body's cells to use (Campbell and Campbell 2006, 281). In a way, insulin is the traffic cop that directs the glucose from the blood into the individual cells. Therefore, consuming a high concentration of carbohydrate rich foods raises blood glucose, which the body responds by increasing insulin released. Extremely high insulin levels is the body's response to being overwhelmed with glucose as it has to start storing the excess glucose for later use in the form of fat (Campbell and Campbell 2006, 281; Davis 2011, 47; Jaminet, Jaminet,

and Sisson 2012, 200). The resultant body fat storage preference in the presence of excess blood glucose levels might be a reason for the negative results when high carbohydrate consumption is studied. The higher the glucose levels are, the more unhealthy clinical results are observed. Therefore, maintaining optimal glucose levels can be best managed by consuming appropriate amounts and types of carbohydrates per meal and throughout the day.

So, what are the levels when carbohydrates become unhealthy? The *Perfect Health Diet* states that carbohydrates should only make up 20 to 35 percent of calories with 85 percent of that coming from glucose and only 15 percent from fructose (Jaminet, Jaminet, and Sisson 2012, 193). The *Dietary Guidelines for Americans, 2010* quotes 45 to 65 percent. A couple of studies reviewed did not find a significant long-term difference, meaning greater than six months, in weight loss results between diets of different carbohydrate quantities (Krebs and Parry-Strong 2013, 60-66; Sacks et al. 2009, 859-873). However, these two studies did show some slight benefits concerning increases in HDL in blood work for the low carbohydrate diets. Ultimately, it seems limiting carbohydrates, especially fructose derived from refined sugars, toward the lower end of the USDA and HHS recommendations within a person's bodily needs could be prudent.

Protein

Protein has always seemed to have a firm place in the American diet. The 1944 U.S. Navy cookbook claimed its name to be fitting since it means "to take first place" (United States 1944, 1). This is why, whenever muscle growth, fitness, strength, and diet are brought up, protein enters the conversation almost immediately. Amino acids are the building blocks that make up a protein. In order for the body to use protein it must first

break the protein down into the smaller amino acids and then reassemble them in the order needed for its use in the body (Campbell and Campbell 2006, 83). There are many different protein types that when broken down contain different amounts of chained amino acids. For instance, casein is a type of protein that makes up 87 percent of cow's milk protein (Campbell and Campbell 2006, 44). Protein has many uses in the body and is essential for the sustainment of life and health.

Dietary proteins are extremely important because many amino acids are required to maintain the body's proteins. Of the amino acids the body uses, it cannot synthesize nine of them internally. Therefore, those nine amino acids are known as essential amino acids because they must be provided through diet. Dietary proteins are needed to rebuild or replicate proteins as they wear down or are injured. If one of the nine amino acids is missing, that could slow down the process and can become extremely dangerous if the situation persists. The food sources that provide a complete protein, meaning all essential amino acids provided in the appropriate ratios for the body's use with each bite are animal meats. Some plant proteins do not provide all the essential amino acids at the required levels. For instance, broccoli and spinach are both low in the amino acids methionine and cystine, but blackeyed peas and asparagus have all amino acids in the proper ratio and are complete (Frazier 2012). Therefore, consuming a variety of plant foods will provide the body with all the essential amino acids at levels it needs (Campbell and Campbell 2006, 83-85; Cordain and Friel 2005, 1168). The question of which sources are better to obtain protein from seems to be where a lot of the research on protein is focused.

The China Study is very adamant that the answer to the protein source question is plant foods. The book references multiple sources that illustrate the same conclusion as the 1983 study, which the book is centered around. It is the author's conclusion that animal protein is the source of a majority of the chronic health issues in existence today, including cancers and cardiovascular disease (Campbell and Campbell 2006, 66). Current studies researched for this thesis came up with mixed conclusions when considering animal protein and different types of meat.

There is not a universal agreement that animal proteins should be avoided. In fact, some of the most pertinent research has shown that overall lifestyle, type of animal proteins chosen, and amount of protein consumed all combined is really what should matter. One study showed many vegetarians live healthier overall lifestyles (i.e exercising, non-smokers, no to low alcohol consumptions) and hypothesized that that may cause inconsistent data when compared to unhealthy living meat eating people. That same study after considering lifestyle only showed an increased risk of diet related death associated with a high consumption of processed meats but did not find a negative effect for red meat or poultry (Rohrmann et al. 2013, 63). Processed meats have shown to be an unhealthy choice in multiple studies (Beck 2013, L.4; U.S. Department of Agriculture 2010, 27). Its high levels of saturated fat, sodium, and nitrites are believed to be reasons for processed meats' negative impact on health (Beck 2013, L.4). However, it is also important to consider the total amount of protein consumed because of the way the body handles the excess. The body does two things with excess protein, it uses it for energy right away or stored as glucose in the liver (Cordain and Friel 2005, 1363). Both of those ways result in nitrogen production as the body disposes of the excess protein. The

nitrogen is then turned into ammonia, which can cause problems if the body cannot flush it out quickly enough. This condition can occur whether the excess protein comes from animals or plants (Jaminet, Jaminet, and Sisson 2012, 88; Weil 2011, 181). However, since animal meat is a denser protein source than plants, it is easier to achieve excess protein consuming animal meats.

Some of the inconsistent conclusions between animal proteins and its possible negative impacts on health are probably why animal lean meats are still recommended as part of a healthy diet by most nutritionists. The NOFFS website has a simple recommendation when it comes to choosing animal proteins, “less legs is better” (Commander Navy Installations Command 2013b). The idea behind that rule is NOFFS recommends animal protein choices in the following order: seafood, poultry, pork, and beef, which seems like a good rule to follow. Interestingly, protein recommendations as a percentage of caloric intake has been pretty consistent in the United States and its Navy. A 1904 study in the United States found the average protein consumption for Americans was about 13 percent (Langworthy and Milner 1904, 14), the 1944 U.S. Navy cookbook suggested 10 to 15 percent (United States 1944, 3), and the most recent dietary recommendation from the Institute of Medicine gives a range between 10 to 35 percent (U.S. Department of Agriculture 2010, 15). It is worth noting that high intakes of protein have shown through some studies to increase cancer risk. A study discussed in *The China Study* found 20 or greater percent of calories as protein to be the point when cancer occurred at the highest rates (Campbell and Campbell 2006, 43). Therefore, the protein intake should be adjusted depending on requirements of the body to replace, rebuild, and repair its proteins.

Fat

Though carbohydrates have started to gain a negative connotation for some nutritionists, fat is still one of the most feared words in the nutritional world. Walking through the supermarket one cannot help but notice all the low-fat or non-fat claims and options. The huge branding on the side of your favorite twisted licorice candy confirms it is a fat free food, thank goodness. There are many reasons for this fear, including saturated fat and its studied associations with heart disease risk, the fact that one gram of fat is about nine calories while proteins and carbohydrates per gram is only about four, and that fat in the body is undesirable, therefore removing it from the diet makes sense. So, is the fear of fat warranted?

Fat, just like the other two macronutrients, is not as simple as the three letters which spell the word. There are two types of dietary fats: saturated fats and unsaturated fats. Though many people watch the amount of the fat intake in their diet, most people will concede that not all fat is bad. In its guide for lowering cholesterol from 2005, the HHS described a view that many people take towards dietary fat. It states that not all fat is bad, but it is high in calories. Total fat intake is not necessarily harmful, but many fatty foods do contain saturated fat. The department's recommendation is that eating less total fat should mean less saturated fat, but if fat is consumed it should be unsaturated (U.S. Department of Health and Human Services 2005, 23). As illustrated from this paraphrased HHS recommendation, saturated fat is the "bad" fat and one should avoid it to such a degree that limiting total fat is good because it will likely reduce saturated fat intake. Most reading this will understand that the topic of fats has somewhat changed since 2005, but "good" fats and "bad" fats are still a very big part of nutritional

recommendations. The problem is that there is not clear evidence which fats are good or bad, as data is inconsistent.

Although somewhat feared, there is no denying that fat plays a vital role in maintaining a healthy and fully functional body. The human body has many uses for dietary fat. Just like protein's essential amino acids, fat has two acids that the human body cannot make on its own. These essential fatty acids, both polyunsaturated, are linoleic acid (omega-6) and alpha-linolenic acid (omega-3) and must come from food. The role of these essential and other fatty acids are used for maintenance tasks in the body such as cell membrane integrity, boosting immune system function, and skin tissue construction. Fat also allows the body to absorb fat-soluble vitamins A, D, E, and K (Ryan 2007, 357). The importance of dietary fat is undeniable, so the question for fat really deals with amount, ratios, and types consumed.

Saturated fat is responsible for a lot of the fear associated with fat consumption. As discussed earlier, in an attempt to lower saturated fat intake, some nutritionists have recommended the lowering of the amount of total fat consumed. The fear of saturated fat, the reason it is labeled by many nutritionist as the "bad" fat, comes down to the observation that "populations that tend to eat more saturated fat have higher cholesterol levels and more heart disease than those with lower intakes" (U.S. Department of Health and Human Services 2005, 20). This association might be clear but two articles reviewed, both published by American Society for Nutrition, stated the whole picture is not understood. They claimed the nutritional community has not studied how saturated fat really works in the body, but rather how it affects the blood. The conclusions are drawn from its association with heart disease blood measurement risk factors. There is a belief

that the studies need to go beyond the effects fatty acids have on cholesterol numbers (German and Dillard 2004, 550-559; Lawrence 2013, 294-302). One meta-analysis study did just that and looked at 21 different clinical studies, which involved 347,747 people, to evaluate the direct association with saturated fat and cardiovascular disease. They concluded there was not significant evidence to link saturated fat intake with cardiovascular disease (Siri-Tarino et al. 2010a, 535-546). So, what is the verdict on saturated fat? Most nutritionist and health experts continue to recommend lowering saturated fat intake and without conclusive evidence one way or the other that suggestion seems understandable.

If saturated fat is the “bad” fat, fats which are not saturated have come to be known as “good” fats. These “good” fats also have a bit of an inconsistent record when it comes to healthy food choices. However, when these fats are broken down into smaller groups some consistencies do begin to form. The fats concerned can be further categorized into smaller groups: unsaturated fats, which include monounsaturated and polyunsaturated, and trans fats. The belief at one point was to avoid only the saturated fat and other fats should be better. However, today, most nutritionists recommend consuming no trans fat, which is produced from hydrogenised liquid oil (Ryan 2007, 35; U.S. Department of Agriculture 2010, X). Monounsaturated fats and diets that promote it are mostly recognized as being associated with positive health benefits including weight loss, lower diabetes risks, and lower cardiovascular risks (Augusti, Faizal, and Suneesh 2009, 283; Krebs and Parry-Strong 2013, 63-64; U.S. Department of Health and Human Services 2005, 23). The final fat of the three types of unsaturated fats, polyunsaturated fat, is associated with the most controversy.

Though many nutrition references promote polyunsaturated fats as healthy, there is emerging evidence to suggest that an appropriate balance between the omega-6 fatty acid and the omega-3 fatty acid is actually the key. As mentioned previously, these two fatty acids are essential. However, they seem to have an opposite relationship with each other as they compete for use in the body. What this means is that when linoleic acid (omega-6) greatly exceeds the presence of alpha-linolenic acid (omega-3) there is evidence of increased inflammation in the body. This relationship has reared its head in many clinical studies and higher omega-6 fatty acid to omega-3 fatty acid ratios have been linked most consistently to an increased risk of cancer and heart disease (Augusti, Faizal, and Suneesh 2009, 283; De Lorgeril and Salen 2012, 50; German and Dillard 2004, 552; Jaminet, Jaminet, and Sisson 2012, 288; Lawrence 2013, 294-302; Nozue et al. 2013, 6-11). Though many examples were found which link higher omega-6 to omega-3 fatty acids, a 2009 article by the AHA does not make a strong case one way or the other. It shows some evidence that omega-6 fatty acids reduces chronic heart disease risk factors, meaning it reduced cholesterol, when replacing saturated fats and carbohydrates in the diet, but does not directly answer the ratio question. Also, some studies that this article used as evidence, increased omega-3 intake along with the omega-6 fatty acids in the diets used during the experiment (Harris et al. 2009, 902-907). Ultimately, with the average western diet ratios, by some estimations, sitting around 15 to 1 (omega-6 to omega-3) and when some claim the human body functions best with a ratio as low as a 1 to 1, then an overall reduction should be beneficial (Simopoulos 2002, 365-379).

There does seem to still be a debate on the appropriate amount and type of fat to be in a diet. Current recommendations from the USDA suggest that between 20 percent and 35 percent of caloric intake should come from all fats and less than 10 percent of calories should come from saturated fat (U.S. Department of Agriculture 2010, 15). However, there are those that claim higher fat intake is not necessarily bad for health and some claim it to be quite healthy. The argument will continue as long as the evidence and experimental results contradict each other and create questions. What does seem to have the biggest impact on health and the most evidence from articles and research reviewed for this thesis are the ratios of between different fat types. Lowering the ratio of polyunsaturated omega-6 to omega-3 fatty acids seems to yield a positive effect on the health of an individual (Ornish et al. 2013, 1119). And though, the evidence is not fully clear, there is a strong association between saturated fats from animal food sources and its negative effect on heart disease risk factors, including higher total cholesterol and higher LDL levels (U.S. Department of Agriculture 2010, 24). These considerations form a basis that this thesis will use when picking best foods to consume for sailors underway.

Macronutrient Composition

While researching the macronutrients, the question that started to surface was whether there is an optimal macronutrient composition for a person's diet. This topic is a lively one, which is why there are so many diet books on the shelf in the local bookstore. It seems like every book has a new way to adjust the percentages of the different macronutrients to make up a person's diet. What is the answer? What is the magical macronutrient composition? The most likely answer is, it depends.

Now, it depends, is not a very helpful answer but it seems to be the only conclusion that can be drawn from the research for this thesis. A couple of the prime sources for this paper, *The Perfect Health Diet*, *Good Calorie, Bad Calorie*, and *The Wheat Belly*, conclude that a diet with low to moderate carbohydrate intake is generally healthier. On the other hand, the *Dietary Guidelines for Americans, 2010* by HHS and USDA and *The China Study*, suggest a higher level of carbohydrates between 45 to 65 percent. Furthermore, the 2010 Dietary Guidelines states there is strong evidence to suggest there is not an optimal macronutrient distribution for weight loss (U.S. Department of Agriculture 2010, 15). How can there be such a difference in opinion?

Many of the different opinions come from inconsistent data. Of the experiments examined during research, many of the inconsistent results are rooted in how the experiments were carried out. The biggest difference in results came down to the amount of time the experiment covered. The longer (over 12 months) the clinical studies lasted the smaller the differences between macronutrient compositions became, when all else remained constant (Dansinger et al. 2005, 43-53; Foster et al. 2012, 249-254; Krebs and Parry-Strong 2013, 60-66; Sacks et al. 2009, 859-873). The shorter (less than six months) a study was the more positive results came from lower carbohydrate diets in weight loss and many chronic disease risk factors (Ebbeling et al. 2012, 2627-2634; Sacks et al. 2009, 859-873). Therefore, the percentage division between macronutrients in a person’s diet probably should be an individual consideration depending on results, preferences, and environment. Perhaps the lower carbohydrate diets showed better results in the short term studies because it was different than the norm and the body was not given time to adjust to the new diet.

Cholesterol

Just as dietary fat does not turn directly into body fat, dietary cholesterol is not directly responsible for high cholesterol in the blood (Campbell and Campbell 2006, 163; Cordain and Friel 2005, 2693; Jaminet, Jaminet, and Sisson 2012, 89; Taubes 2007, 19). However, there is still a recommendation by many in the nutritional community to limit foods that are high in cholesterol (U.S. Department of Health and Human Services 2005; U.S. Department of Health and Human Services 2006). The recommendation currently is to consume less than 300 mg by the *Dietary Guidelines for Americans, 2010* (U.S. Department of Agriculture 2010, X). The Therapeutic Lifestyle Changes (TLC) promoted by National Heart, Lung, and Blood Institute suggests that lowering dietary cholesterol to less than 200 mg/day reduces LDL cholesterol in the blood by 3 to 5 percent (U.S. Department of Health and Human Services 2005, 16). As per these recommendations, foods lower in cholesterol should make for better food choices. This is one reason these same organizations recommend lean cuts of meat for consumption, which have lower saturated fat and cholesterol content than less lean cuts.

Sodium

High sodium consumption has been a concern for the health community for some time. There has been a big push for companies to lower the amount of sodium in their foods. A high amount of sodium intake in the United States, which averages 3300 milligrams, mainly comes from processed foods. The biggest processed food contributor is bread (Peltz 2013, ZE.4). These processed foods are everywhere and are prevalent across American cafeterias and galleys of U.S. Navy warships. However, processed foods have big benefits for food services, they are cheap and they do not spoil as quickly as

other foods could. Therefore, on a ship that is at sea, processed foods will probably remain as part of sailor's food selections. There are some strategies that could minimize sodium's negative impact on the individual.

"Because sodium intake is casually related to high blood pressure, an established risk for cardiovascular disease, reductions in sodium intake have been seen as an essential component of national public health policy for the past several decades" (Boon, Taylor, and Henney 2010, 22). Sodium is thought to cause high blood pressure because as more sodium is consumed our blood cells retain more water, thus expanding in size (Taubes 2007, 146). That expansion is believed to put pressure on the cardiovascular system from the veins, to the organs, and to the heart. If the condition persists, the stress of high blood pressure could result in cardiovascular disease. For these reasons, a reduction in high sodium consumption is recommended.

There is another point to consider concerning sodium's affect on the body. Some have theorized that high sodium intake might not be the whole story. The theory is it might not be an excessive amount of sodium that is the problem but a deficiency in potassium. As with many nutrient interactions in the body, sodium and potassium have an important inverse relationship with each other. This relationship means that as potassium intake goes up, the effects of sodium on blood pressure goes down (Jaminet, Jaminet, and Sisson 2012, 638; Institute of Medicine (US) Panel on Dietary Reference Intakes for Electrolytes and Water 2005, 271; Peltz 2013, ZE.4). There is also evidence that higher sodium to potassium ratios result in an increase in calcium excretion, reducing calcium absorption (Institute of Medicine (US), Panel on Dietary Reference Intakes for Electrolytes and Water 2005, 467).

The sodium to potassium relationship appears to be important, especially in situations when higher levels of sodium intake cannot be avoided.

Calcium

Calcium, as most people are well aware, is essential for bone health. “A positive calcium balance is necessary for maximal bone adaptation to mechanical loading” (Lappe et al. 2008, 742). The key term in the last quote is “positive calcium balance,” which includes consumption, absorption, and retention. In some ways, it is the absorption that needs to be focused on in a person’s diet. In older women, calcium supplementation has not clearly shown a reduction in hip fracture rates (Jaminet, Jaminet, and Sisson 2012, 643). This could be due to the body’s need for other nutrients to properly absorb and retain the calcium consumed.

The nutrients found most associated with calcium absorption during research were vitamin D and potassium. The vitamin D and calcium relationship has been known for a long time, which is one reason why cow milk is fortified with the nutrient to aid absorption. Potassium’s association with calcium was mentioned previously in the sodium section. The reason this connection exists is because both potassium and calcium are alkaline. Therefore, when conditions cause the body’s acidity level to increase, potassium is the body’s first choice to neutralize the condition. When potassium is unavailable, the body extracts calcium stored in the bones (Institute of Medicine (US). Panel on Dietary Reference Intakes for Electrolytes and Water 2005, 186-189). The robbing of the bone’s calcium means there is a negative calcium balance. The health of the bones is now in jeopardy if the condition continues (Lappe et al. 2008, 741-749). This

once again shows the importance of nutrients, their interaction with each other, and potassium’s potential importance in sailor food choices.

Conclusion

The research and this chapter began by looking into some of the programs and initiatives the U.S. Navy has in place to address nutrition. The ones that have most potential use for its sailors are Galley Go Green and NOFFS. However, when looking into these programs, it seems that the focus is still on the sailor at home and not necessarily underway. Though Galley Go Green has begun to make its way to some ships, the program was created for use at shore-based galleys across the fleet. In the same respect, NOFFS created a nutrition program that is accessible and easy to understand but has some difficult principles to accomplish underway. For instance, since a ship only has four meal times, the eating six times at evenly spaced intervals is not feasible if the galley is a sailor’s sole source of food. These programs are a great resource for sailors and this thesis will use parts of their lessons during the analysis portion. Therefore, focusing on the menu and living conditions aboard a ship underway is the only way to tailor an optimal nutrition plan for that situation.

So then, what is an optimal nutrition plan? As stated in chapter 1, as a limitation, nutrition is a very broad subject and many very good references and clinical studies may not been reviewed for this thesis. Therefore, the research aimed to focus on information that would pertain to sailors and the foods they have access to while underway. Without a medical degree in nutrition, the recommendations given by the USDA and HHS in their *Dietary Guidelines for Americans, 2010* will still be used as a framework moving forward. However, as those recommendations are purposely broad to account for many

situations, this research has provided a more detail understanding of what a diet could look like for sailors underway to promote health.

The nature of food served onboard U.S. Navy ships is similar to food served in many cafeterias and food courts across the country. The food must be portable, stay fresh for long periods between replenishments, and quick to cook and serve. These requirements force the U.S. Navy to depend on processed and prepackaged foods for many of its menu items. This is not to say that the food served aboard ships is inherently unhealthy, instead, it is a fact to consider. The use of processed foods does generate a few expectations of nutritional quality. Many processed foods are characterized as being high in sodium, sugar, fat, and low in nutrient density. Those characteristics are important to understand. The nature of the food is the reason the following research supported takeaways are so important in generating healthy food choices onboard a U.S. Navy aircraft carrier:

1. As discussed previously, the daily nutritional guidelines designed by the USDA and HHS will be adhered to when making recommendations for how to make food choices and generating suggested meals. The guidelines are broad, which gives room for situation and circumstance when formulating specific recommendations created for ship life.
2. Limiting the amount of added sugar while reducing the glucose to fructose ratio was supported from the evidence gathered during research. The way the body processes excessive sugar through its use of insulin and fat storage maybe the reason clinical studies have shown that added sugar is associated with health risks.

3. Evidence supports reducing the ratio of omega-6 to omega-3 fatty acids. The inverse relationship between these fatty acids means that a higher omega-6 to omega-3 ratio increases the inflammatory response in the body. For instance, evidence has shown diets high in omega-6 fatty acids increase the oxidation of LDL cholesterol, which is believed to promote blood vessel inflammation (Harris et al. 2009, 903). Inflammation responses like these could be responsible for the suggestions to increase omega-3 intake and decrease omega-6 intake.
4. Another ratio to reduce is the ratio of sodium to potassium. As discussed, the nature of serving food on a ship requires some dependence on processed and prepackaged foods. This fact, while not unhealthy in and of itself, means that sodium can be expected to be in high quantities in many menu items. For this reason, potassium becomes extremely important since it has a neutralizing relationship with sodium's affect on health. Most experts agree that high sodium consumption is unhealthy. Therefore, the goal should be to reduce sodium intake while also increase potassium intake. Evidence has shown this lowing of the sodium to potassium to be beneficial and that higher potassium levels may aid calcium absorption as an added bonus.
5. Extremely high levels of protein show evidence of being unhealthy. Protein consumed at levels that exceeds what the body needs results in a potential unhealthy situation as the body disposes of the excess. In order to do this, the extra protein will either be used as an energy source now or stored for later. This process results in ammonia releasing into the body, which becomes a

problem if this happens faster than it can be filtered out (Cordain and Friel 2005, 1363). Therefore, it is important to keep the levels of protein limited to the need of the sailor.

6. Avoiding high quantities of processed meats seems to be the most noncontroversial conclusion of all the takeaways gained from research. The presence of large amounts of sodium, nitrates, and saturated fat in most types of processed meats results in a food that studies consistently show it to be an unhealthy choice (Beck 2013, L.4).

Going forward, using these main points, menu items will be analyzed, categorized, and ranked, in order to provide a solid idea of food choices sailors should make underway. Any conclusions made hereafter will be based on the reference material overviewed in this literature review chapter.

CHAPTER 3

RESEARCH METHODOLOGY

The goal of this thesis is to answer the primary research question posed: What foods choices should sailors make from the menu served to them while deployed onboard U.S. Navy ships? Using a preapproved 21-day menu meal cycle for deployed aircraft carriers, the methodology aims to satisfy that concern. In order to answer the primary question, a few secondary questions need to be answered. They include: What an optimal diet looks like? What is the U.S. Navy's nutritional programs and guidance? And finally, what is the U.S. Navy nutritional information based on? By answering the secondary questions, the information required to answer the primary question will be collected and ready for analysis.

This chapter will outline the research methodology used and how the information was gathered. It will explain what resource types were selected and how the data was filtered for discussion in the literature review in chapter 2. Also, this chapter will introduce the criteria used for analysis in chapter 4. The goal of this chapter is for the reader to gain an understanding of how the work was done and what strengths and weaknesses this process has.

Methodology

The secondary questions guided what type of information needed to be collected and from what resources. All resources are from open sources and the subjects researched determined where to find them.

Initially, the questions concerning the U.S. Navy and its nutritional guidance were answered through resources provided from the U.S. Navy's fitness website, www.navyfitness.org. This website began the understanding of the U.S. Navy's vision for nutrition and provided information of external organizations the U.S. Navy used to base its nutrition guidance.

An optimal diet was the next question this thesis answered. To start the research, five mainstream books were used. They were *In Defense of Food: An Eater's Manifesto* by Michael Pollan, *Good Calories, Bad Calories* by Gary Taubes, *Perfect Health Diet* by Paul Jaminet, Shou-Ching Jaminet, and Mark Sisson, The *Wheat Belly* by William Davis, and *The China Study* by T. Colin Campbell. These books gave a wealth of information from a variety of authors with varying conclusions. This base of knowledge focused the research in medical journals, articles, and clinical trials. Using the nutrients the U.S. Navy provides on its menu items and the main themes from the five books limited the research breadth and allowed more current and relevant scientific data on diet to be found.

Finally, chapter 2 correlated and explained the findings from all these sources. The final piece is presented through the analysis of the nutrient data, values for the individual menu items, and conclusions from chapter 2. Using the recipes provided by the U.S. Navy of menu items, the ingredients will be put into a nutrition calculator provided by nutritiondata.com. The goal for chapter 4 is to provide food choices to sailors that most completed fits the conclusions of an optimal diet outlined in chapter 2. The food choices will be specific for the unique 21-day menu meal cycle. Provided next is the criteria used to select appropriate meal choices based on the research.

The Criteria

The research done for this thesis has generated some key considerations for a healthy diet that will be used to define the food choices a sailor should make. As stated in a National Prevention Strategy from the Office of the Surgeon General in 2011, eating a healthy diet can reduce "people's risk for heart disease, high blood pressure, diabetes, osteoporosis, and several types of cancer, as well as help them maintain a healthy body weight" (National Prevention Council 2011, 36). During the course of research, diet characteristics that reduced those types of ailments were searched in order to formulate the criteria to choose healthy foods from the 21-day menu cycle. Also, as described in chapter 2, the goal was not to find correlation but also to find causation by trying to understand how the nutrients and food choices affected health and risk of chronic disease. From research outlined in chapter 2, the analysis is using the following criteria in order to develop healthy food choices for sailors:

1. The food choices, collectively, must meet the caloric requirement of the individual according to their daily activities and goals.
2. The food choices, collectively, must adhere, as much as possible, to the broad guidelines set out in the *Dietary Guidelines for Americans, 2010* published by the USDA and HHS, in terms macronutrient ranges and micronutrient minimums and limits.
3. The food choices are picked in order to provide the lowest ratio of omega-6 to omega-3 fatty acids.
4. The food choices are picked in order to provide the lowest ratio of sodium to potassium.

5. The food choices are picked in order to provide the lowest ratio of fructose to glucose.
6. The food choices, collectively, will be compared to the nutrient output of the U.S. Navy's established Galley Go Green program, used mostly in onshore galley to help sailors with food choices, in order to determine differences and similarities.

Chapter 4 will explain the analysis of the nutrients, the menu item choices, and the results. The Galley Go Green program is used as a comparison because the U.S. Navy promotes it as a viable way to classify what food is nutritional in its shore based facilities. The relevant nutritional advice discovered during the research as discussed in chapter 2 is the focus of the food choices going forward. By invoking all six criteria, the resulting diet, according to the research done for this thesis, will promote healthy eating while underway onboard a United States Navy aircraft carrier.

Applying the Criteria

The menu items will be further analyzed using nutritiondata.com with the recipes as provided through the Armed Forces Recipe Service. After the menu items are broken down into their smaller nutrient make up, they will be categorized and chosen based on the established criteria. As a comparison, meals will also be developed using the Galley Go Green (GGG) principles. A table similar to table 2 will be used to compare the nutritional value of the three days examined. The USDA and HHS guidelines will be provided on the top line of the chart for comparison of ranges. Also, a normalized and unnormalized set of tables will be generated for comparison. This will be done because an assumption made earlier in chapter one stated that all menu items would be analyzed

as a full serving. Due to this fact, if different menu items are selected between the diets then the resultant meals might not have the same calorie total. Therefore, for a true comparison of a diet's overall nutritional value, tables will be created to set the calories equal, or normalized, between diet versions.

Table 2. Proposed Diet Comparison

	USDA	GGG	Thesis
Calories			
Protein (g) RDA			
Carb (g)			
Total fiber (g) IOM			
Total fat (g)			
Saturated fat (g)			
Cholesterol (mg)			
Calcium (mg)			
Iron (mg)			
Potassium (mg)			
Sodium (mg)			
Vitamin A (mcg RAE)			
Vitamin C (mg)			
Protein (%)			
Carbohydrate (%)			
Total Fat (%)			
Saturated fat (%)			

Source: Created by author.

Strength and Weakness of Method

This method like any other meta-analysis type of research, it has an inherent strength and weakness. This method allows for the analysis from many different sources that have conducted nutritional trials and studies through different means and missions.

Diversity of resources allows multiple possibilities to be considered. On the other hand, the value of the research is only as good as the quality of the resources. Without doing specialized clinical study on the benefits of the food choices recommended, this thesis is solely relying its conclusions based on resources found and used as evidence. This is a characteristic of any other research project but one that is important to mention as a strength and weakness of this process to conclude this chapter.

CHAPTER 4

ANALYSIS

The purpose for this chapter is to provide an expanded explanation of the analysis procedures and, ultimately, answers to the questions asked at the start of this journey. The data and information explained during chapter 2 gives the base understanding for analysis and for this chapter. The effort now will focus specifically on the takeaways discussed in chapter 2 and the criteria of analysis provided in chapter 3. The first goal is to gain an understanding of the types of food provided onboard U.S. Navy aircraft carriers while underway. It is through that gained understanding that will inevitably lead to answering the primary question this thesis asks: Using the 21-day cycle menu for U.S. Navy aircraft carriers underway last updated April 2013, what food choices should a 23 to 25 year old sailor make to ensure maximum health benefits from his or her meals?

The Menu

Chapter 2 discussed in great depth what the U.S. Navy uses in generating an approved menu for its ships and how each galley food service provider has the opportunity to serve unique menu cycles, if they so desire, with approval from U.S. Navy dieticians. However, it was the pre-approved 21-day menu cycle for aircraft carriers that was picked as the sample menu for analysis. Other menu options were available, but the large size and crew of aircraft carriers, theoretically, should provide a menu with the most menu items per day to study.

The menu picked for this analysis was approved in April 2013 for aircraft carrier use (Navy Supply System Command 2013). The menu is divided up into four different

meals: breakfast, lunch, dinner, and midnight rations (MIDRATS). For the purpose of this analysis, three meals will be analyzed: breakfast, lunch, and dinner. Other modifications made for the analysis were omitting some generically labeled menu items that are listed for each meal. Those include items labeled beverage bar, sandwich condiments and deli bar, bread bar, fruit bar, salad bar, and table condiments bar. These were not analyzed since the data was not specific for these items, as the items in these "bars" will change frequently depending on where the ship is deployed, season, and such. However, there were three items added to the menus to cover a few of these categories omitted: non-fat milk is the only beverage analyzed for the beverage bar, a fruit cup in water was a substitute for the fruit bar, and a side salad (iceberg lettuce, mushrooms, spinach, onions, tomatoes, carrots, kidney beans) with Italian dressing was a substitute for the salad bar. As can be expected, though the meal cycle is 21 days long there is still plenty of repetition in menu items across the plan used in different combinations. Therefore, three days were chosen for analysis and picked to provide a wide range of food types and choices that could best represent the whole cycle.

Table 3 shows how the listed menu items for Day 1 look. Each day is set up exactly the same way. The breakfast choices are almost identical for each of the 21 days with only an item change or two. Furthermore, as shown in table 3, lunch and dinner are very similar per day. Again, there is only an item or two difference between lunch and dinner on any given day. However, there is a drastic difference between the lunch and dinner items of the three different days picked. The difference between the days is the reason for their choice. Some of the main lunch and dinner entrees for Day 1 are fried chicken, crab stuffed fish, cheeseburger, and barbeque chicken. Day 14 offers grilled

salmon, barbeque beef sandwiches (Sloppy Joe), roasted turkey sandwich, roast rib of beef (rib eye), and seafood Newburg. The final day used for analysis is Day 18; some of its main courses are chili con carne, shrimp gumbo, spaghetti with meat sauce, hot Italian sandwiches, and roasted turkey (Navy Supply System Command 2013). The complete menus for the three days are provided in Appendix A. The variety of menu items should be evident, which is the reason they were chosen for analysis. The rest of this chapter will use and reference food items assigned to Day 1, 14, or 18 on the 21-day menu cycle for underway aircraft carriers.

Table 3. Day 1 Menu

Breakfast	**Lunch**	**Dinner**
Muffins	Banana Cake	Banana Cake
Breakfast Burrito	Beans, White in Tomato Sauc	Barbecued Chicken
Breakfast Rice	Blueberry Crisp	Beans, White in Tomato Sauce
Cereal (cheerios)	Brownies	Blueberry Crisp
Creamed Beef	Cheese Burger	Braised Beef and Noodles Soup
Egg, Hard	Chili Conqui	Brownies
Egg, Scram (in bag)	Corn Bread	Cheese Burger
English HEC	Crab Stuffed Fish	French Fried Potato
English SEC	French Fried Potato	Fried Chicken
French Toast	Fried Chicken	Gelatin
Grilled Ham, Canned	Gelatin	Green Beans, can
Grits	Green Beans, can	Mac and Cheese
Hash Brown	Mac and Cheese	Mixed Veg
Maple Syrup	Mixed Veg	Onion Soup
Oatmeal	Onion Soup	Pudding 4oz
Oven Fried Bacon	Pudding 4oz	Steamed Rice
Pancakes, Buttermilk	Steamed Rice	Veg Beef-Barley Soup
Salsa	Veg Beef-Barley Soup	
Sausage Gravy w Biscuit		
Sausage Links		
Sausage Patties		
Sweet Dough		
Waffles		
Whole Wheat Rolls		
Yogurt, Assorted 6oz		

Source: Food Service Management (FSM), “FSM AIRFOR April 13 Menus,” https://fsm.navsup.navy.mil/fsm/mainmenu.aspx (accessed June 12, 2013).

Application

With the three days selected, the next step was to input the recipe information into a nutrition-tracking program for further analysis. The program used for this purpose was Nutrition Data, which can be found at http://nutritiondata.self.com. This website provides tracking and nutritional information for foods and ingredients. The recipes provided through the Armed Forces Recipe Service dated from June 21, 2013 (Armed Forces Recipe Service 2013) provided the ingredients for each food item. All that information was entered into the Nutrition Data website for analysis.

For most items, the matter of inputting ingredients into the website was straightforward. The only real issue came up when menu items were prepackaged foods, which only have itself listed as the sole ingredient. This poses somewhat of an issue since the exact product cannot be entered into the nutrition-tracking website. The concern was mostly alleviated because the Armed Forces Recipe Service recipes provide some nutritional facts along with the ingredients, so, the nutritional facts could be compared with similar food items in the Nutrition Data database. Also, data for the food items used during analysis will be from the same single source, the Nutrition Data website. An example of one such food item, frozen waffles, is provided in table 4.

Table 4. Waffles Frozen, Brown and Serve (100 portions)

<table>
<tr><th>Calories</th><th>Carbs</th><th>Protein</th><th>% Cal from Fat</th><th>Chol</th><th>Sodium</th><th>Fiber</th><th>Calcium</th></tr>
<tr><td>193 kcal</td><td>29 gm</td><td>4.5 gm</td><td>31.7%</td><td>40 mg</td><td>44 mg</td><td></td><td>27 mg</td></tr>
<tr><td colspan="3">Ingredients</td><td colspan="3">Weight</td></tr>
<tr><td colspan="3">Waffles, Belgian</td><td colspan="3">10 lbs 8 oz</td></tr>
</table>

Source: Armed Forces Recipe Service, “21June 2013 FSM AFRS,” https://www.nko.navy.mil/group/food-services/home (accessed September 18, 2013).

The example in table 4 gives the reader an idea of what information is provided for each food item by the Armed Forces Recipe Service. As can be seen, the service provides minimal nutritional information, which made it imperative to utilize a nutrition-tracking service such as Nutrition Data to expand the nutritional understanding and composition of each menu item. Even so, the data provided enough information to compare with the resultant calculations from the Nutrition Data website for each food item. Though there were some slight differences between the two sources, the data was very close in the seven reported categories. Furthermore, during analysis the diets will all be compared only using the Nutrition Data information, thus removing the minor differences from the two sources.

After the completion of inputting the data, 107 unique menu items were accumulated from the three days being analyzed. Also, by utilizing the Nutrition Data website, the number of nutrient categories with usable data rose from the seven provided by the Armed Forces Recipe Service to 18. Those 18 categories provided a more comprehensive view of each of the menu items and allows for broader comparison between each total day food selection. Furthermore, and maybe more importantly for this thesis, the 18 categories included the nutrients potassium and sodium, omega-3 and omega-6 fatty acids, and sugar, fiber, and total carbohydrates. Chapter 2 concluded these nutrients could be key in a healthy diet.

As a review, three main takeaways from chapter 2 concerned the following:

1. Evidence gathered during research supported a diet that limited the amount of added sugar consumed while reducing the glucose to fructose ratio. With this goal in mind, a sugar to net carbohydrates ratio was used to rank food items

according to their glucose to fructose ratio potential. This ratio is being called a glucose to fructose ratio potential since data was not consistent from the Nutrition Data website on the glucose, fructose, and starch amounts in each food. Therefore, by employing this ratio, one can gain an understanding of the ratio between sugar and net carbohydrates. Net carbohydrates, which are total carbohydrates minus dietary fiber, results in a combination of sugar and starch. The body, as discussed in chapter 2, digests starches directly into glucose. But it is sugar that comes in a variety of forms with glucose and fructose being two of the more commonly consumed through the use of sucrose, or table sugar, and high fructose corn syrup as added sugars. Therefore, the sugar to net carbohydrates number is an indirect way to compare the possible glucose to fructose ratio between food items, hence using the term "potential."

2. The next nutrient ratio highlighted in chapter 2 was the omega-6 to omega-3 fatty acid ratio. Many health experts suggest an increased consumption of omega-3 fatty acids. The research done for this thesis did conclude the same thing, however, this was found to be more due to the lopsided consumption of omega-6 fatty acids than anything powerful in the omega-3s. Therefore, the goal of reducing the ratio between omega-6 and omega-3 fatty acids means both a reduction in omega-6 and an increase in omega-3 fatty acids is beneficial.
3. The final ratio used for selecting foods was the ratio of sodium to potassium. Sodium has an extremely bad reputation in high quantities, but evidence explained in chapter 2 showed that increasing the intake of potassium might be

equally as important. Also, there could be a case for it being even more important in situations where high sodium foods are unavoidable such as being deployed on ships or in cafeterias where there is dependence on processed and prepackaged foods.

It is these three numbers that were used to classify the menu items and form diets for comparison.

The fictitious sailors for this analysis were a male sailor defined as 70 inches tall, weighing 170 pounds, 25 years of age and a female sailor 65 inches tall, weighing 145 pounds, 23 years of age. These sailors would eat three meals a day: breakfast, lunch, and dinner. Using those sailors' ages, genders, and measurements, the NOFFS website was consulted for suggested caloric intake requirements for sailors wanting to maintain their weight. Since the NOFFS food plan suggests six small meals per day but only three meals are being analyzed, the snacks were added to the total required calories for each meal. As a result, the male sailor would have 780 to 900 calories for breakfast, 910 to 1050 calories for lunch, and 910 to 1050 calories for dinner, which totals 2600 to 3000 calories per day (Commander Navy Installations Command 2013c). For the female sailor the calorie requirement totals were 2000 to 2300 per day with 600 to 690 calories for breakfast, 700 to 805 calories for lunch, and 700 to 805 calories for dinner (Commander Navy Installations Command 2013c). An important point to keep in mind is that this NOFFS virtual meal builder has calorie ranges because the weight classifications are ranged as well. The male weight category was for men between 161 to 190 pounds and the female range was 131 to 160 pounds. Therefore, when the calories were normalized for comparison between the different diets the middle of the calorie range was used. This

meant, for this thesis, the male sailor diet goal was 2800 calories per day and the female goal was 2150 calories.

With the calories set, the next step was to find the nutritional recommended daily allowances for each gender and aged sailor. This information was used from the *Dietary Guidelines for Americans, 2010* as outlined in chapter 3. The resultant guidelines are shown in table 5 for both male and female aged between 19 to 30. The calorie requirements discussed in the previous paragraph are added as well in order to complete the table. These requirements will be used as a measure for the diets created to ensure they meet the basic standards.

Table 5. Male and Female (19-30) Daily Dietary Requirements

	Male (19-30)	Female (19-30)
Calories (NOFFS)	2800	2150
Protein (g) RDA	56	46
Carb (g)	130	130
Total fiber (g) IOM	34	28
Cholesterol (mg)	<300	<300
Calcium (mg)	1000	1000
Iron (mg)	8	18
Potassium (mg)	4700	4700
Sodium (mg)	<2300	<2300
Vitamin A (mcg RAE)	900	700
Vitamin C (mg)	90	75
Protein (%)	10-35	10-35
Carbohydrate (%)	45-65	45-65
Total Fat (%)	20-35	20-35
Saturated fat (%)	<10%	<10%

Source: U.S. Department of Agriculture, *Dietary Guidelines for Americans, 2010* (Washington, DC: Department of Agriculture, 2010), 76.

The final point of discussion before the results of analysis are shown is which diet methods will be used for comparison. Table 5 outlines, in most cases, the minimum nutrients required to be in a sustainable diet, but meeting those minimums does not necessarily qualify it as the healthiest diet. Therefore, the Galley Go Green program, discussed in chapter 1 and 2, will be used as another gauge to measure the meal choices this thesis selects against. In order for range of comparison, two diets will be created using the Galley Go Green principles. One diet will be called the Green diet, meaning that all items selected will be classified as “green” foods by the Galley Go Green program, as available. The other diet will be the Red diet, meaning that all items selected will be categorized by the Galley Go Green program as poor choices or “red” items. The only rule aside from that is each meal must have at least one entrée, one side item, and satisfy the calorie requirement. In order to help classify the menu items, the galley website at Naval Medical Center, Portsmouth, Virginia was consulted for Galley Go Green classifications. Their galley posted their 2012 menu with the classifications for each of their menu items (Naval Medical Center Portsmouth 2012). For items not on their website, the principles discussed in chapter 2 were used for classification. The Galley Go Green program is used as comparison because it is a U.S. Navy supported program, based on the Department of Defense’s Go For Green nutritional program, used throughout the shore-based galleys designed to help sailors make healthy food choices. Therefore, in a way, it is a known and approved meal generating method.

The parameters have all been set and discussed. Next, the results for the male and female diets will be shown and explained. Using the three ratios discussed earlier (sodium and potassium, sugar and net carbohydrates, and omega-3 and omega-6 fatty

acids) food choices will be selected to improve positive health affects from a diet consumed underway on a U.S. Navy aircraft carrier.

Results

The data that follows is the result of menu choices which stressed foods that had the lowest sodium to potassium ratio, omega-3 to omega-6 ratio, and sugar to net carbohydrates ratio. Table 6 is the male average per day consumption over the three days picked (Day 1, 14, and 18) before the calorie amounts between diets were normalized. As discussed in chapter 3, the normalization process will even out the total calories for all the diet in order to create an equal comparison between the different diets created. Table 7 shows the normalized average consumption per day for the fictional male sailor and table 9 is the female results normalized. As seen when comparing table 7 and table 8, the Red diet was only used for comparison with the male diets.

Table 6, 7, 8, and 9 were the results of averaging the food selections for the three days picked for analysis. As discussed in the application section of this chapter, the Green and Red diets were created based on the Galley Go Green program. The reason for the Green 1 and Green 2 column was due to the fact that menu Days 1 and 14 both had two "green" Galley Go Green classified entrées available for dinner. Therefore, two "green" diet options were calculated separately. Another note on the tables to mention concerns the vitamin A numbers. It looks as though the numbers are extremely high, but the dramatic difference between the requirement and the result is due to the way vitamin A is defined. Nutrition Data reports vitamin A values in international units (IU), which are not the same thing as the retinol activity equivalents (RAE) as published in the *Dietary Guidelines for Americans, 2010.* The numbers cannot be easily converted either because

it depends on what the vitamin A source is coming from. For instance, 1 IU of beta-carotene from food equals .05 microgram RAE but from a supplement, 1 IU equals .15 microgram RAE (National Institutes of Health 2013). Therefore, without knowing the exact source of the vitamin A the number was left in its IU from Nutrition Data for even comparison between diets. Finally, in regards to the macronutrient percentages, they add up higher than 100 percent per day. The reason for this is because when calculating calories from grams of fat, carbohydrates, and protein the commonly used conversion numbers were used nine, four, and four, respectively. Though these numbers are used often they are rounded numbers and thus created a greater than 100 percent macronutrient solution. With the table's format and considerations touched on, the discussion will move to the methods of food selection.

Table 6. Male Diet Comparison (average per day consumption) Not Normalized

	Male (19-30)	Green 1	Green 2	Red	Thesis (RD)	Thesis (Ranked)
Calories (NOFFS)	2600-3000	2759.3	2785.7	2810.9	2844.4	2790.5
Protein (g) RDA	56	180.9	184.1	148.6	143.7	171.7
Carb (g)	130	403.2	410.6	287.9	408.1	338.4
Total fiber (g) IOM	34	53.5	54.5	19.4	49.0	42.8
Total fat (g)		58.6	56.9	119.7	79.6	90.0
Saturated fat (g)		16.5	16.8	37.8	24.7	24.7
Cholesterol (mg)	<300	397.6	385.0	426.8	304.0	343.2
Calcium (mg)	1000	2137.3	2075.4	610.9	2043.2	1561.1
Iron (mg)	8	71.1	70.5	24.5	50.9	40.7
Potassium (mg)	4700	7380.8	7379.8	3590.7	6535.1	6724.1
Sodium (mg)	<2300	6239.9	6375.0	4532.2	5337.9	4714.7
Vitamin A (mcg RAE	900	38078.9	38390.9	3666.6	24362.9	24539.0
Vitamin C (mg)	90	178.2	176.3	85.2	167.7	189.5
Protein (%)	10-35	26.23%	26.44%	21.15%	20.20%	24.61%
Carbohydrate (%)	45-65	58.45%	58.96%	40.96%	57.40%	48.51%
Total Fat (%)	20-35	19.12%	18.37%	38.33%	25.19%	29.02%
Saturated fat (%)	<10%	5.39%	5.44%	12.09%	7.80%	7.98%
Omega 6:3 ratio		6.771	8.216	9.653	3.189	4.450
Sugar:NC ratio		0.484	0.486	0.251	0.450	0.286
Na:K ratio		0.854	0.879	1.372	0.836	0.715

Source: Created by author with data generated using Nutrition Data, http://nutrition data.self.com (accessed October 20, 2013).

Table 7. Male Diet Comparison (average per day consumption) Normalized

	Male (19-30)	Green 1	Green 2	Red	Thesis (RD)	Thesis (Ranked)
Calories (NOFFS)	2800	2800	2800	2800	2800	2800
Protein (g) RDA	56	183.6	185.1	148.0	141.4	172.3
Carb (g)	130	409.1	412.7	286.8	401.8	339.5
Total fiber (g) IOM	34	54.3	54.8	19.3	48.2	42.9
Total fat (g)		59.5	57.2	119.2	78.4	90.3
Saturated fat (g)		16.8	16.9	37.6	24.3	24.8
Cholesterol (mg)	<300	403.5	387.0	425.1	299.2	344.3
Calcium (mg)	1000	2168.8	2086.1	608.5	2011.4	1566.4
Iron (mg)	8	72.2	70.9	24.4	50.1	40.8
Potassium (mg)	4700	7489.5	7417.7	3576.7	6433.1	6746.9
Sodium (mg)	<2300	6331.8	6407.8	4514.7	5254.7	4730.7
Vitamin A (mcg RAE	900	38640.1	38588.5	3652.4	23982.9	24622.2
Vitamin C (mg)	90	180.9	177.2	84.9	165.1	190.2
Protein (%)	10-35	26.23%	26.44%	21.15%	20.20%	24.61%
Carbohydrate (%)	45-65	58.45%	58.96%	40.96%	57.40%	48.51%
Total Fat (%)	20-35	19.12%	18.37%	38.33%	25.19%	29.02%
Saturated fat (%)	<10%	5.39%	5.44%	12.09%	7.80%	7.98%
Omega 6:3 ratio		6.771	8.216	9.653	3.189	4.450
Sugar:NC ratio		0.484	0.486	0.251	0.450	0.286
Na:K ratio		0.854	0.879	1.372	0.836	0.715

Source: Created by author with data generated using Nutrition Data, http://nutrition data.self.com (accessed October 20, 2013).

The two thesis diet selections will be called the Thesis Raw Data (RD) and Thesis Ranked. The RD diet selection is called raw data because it uses the calculated ratios in the three categories for food items and adds them together, and then the foods are sorted from lowest to highest. The foods with the lowest total number value were selected in ascending order until the calorie requirement for that meal was satisfied. The concern with this method was that the values for omega-6 to omega-3 ratios were a lot larger than the other two ratios. Therefore, this way of selection was unintentional weighting the omega-6 to 3 ratio considerably higher than the other two ratios. This was not a largely bad situation as a diet for comparison or in principle, if someone wanted to weight one of the three categories; however, to combat that characteristic and give a more evenly weighted selection process the Ranked system was employed. This version of food

selection required each food item to be ranked by each ratio against the other food items in each meal from lowest to highest. The three ranks would then be added together and again the lowest valued food would be the first item selected until calories were met (see table 12). In both diet selection methods, the selections were based only on the numerical value of the added numbers.

Table 8. Female Diet Comparison (average per day consumption) Not Normalized

	Female (19-30)	Green 1	Green 2	Thesis (RD)	Thesis (Ranked)
Calories (NOFFS)	2000-2300	2154.3	2180.6	2154.1	2198.0
Protein (g) RDA	46	146.4	149.6	122.5	150.3
Carb (g)	130	294.6	302.0	312.8	223.7
Total fiber (g) IOM	28	36.6	37.6	35.8	31.4
Total fat (g)		50.8	49.0	51.9	82.0
Saturated fat (g)		14.3	14.6	16.1	22.6
Cholesterol (mg)	<300	351.4	338.8	211.3	334.8
Calcium (mg)	1000	1551.8	1489.9	1779.8	1135.3
Iron (mg)	18	59.9	59.3	35.8	30.7
Potassium (mg)	4700	5698.7	5697.7	5408.4	5441.8
Sodium (mg)	<2300	4394.3	4529.5	4100.8	3962.8
Vitamin A (mcg RAE)	700	34873.3	35185.3	14048.9	16883.0
Vitamin C (mg)	75	144.9	143.0	126.2	158.8
Protein (%)	10-35	27.19%	27.45%	22.75%	27.35%
Carbohydrate (%)	45-65	54.70%	55.40%	58.08%	40.71%
Total Fat (%)	20-35	21.21%	20.22%	21.70%	33.58%
Saturated fat (%)	<10%	5.97%	6.03%	6.73%	9.24%
Omega 6:3 ratio		7.108	8.889	2.894	4.293
Sugar:NC ratio		0.478	0.480	0.442	0.202
Na:K ratio		0.782	0.813	0.817	0.746

Source: Created by author with data generated using Nutrition Data, http://nutrition data.self.com (accessed October 20, 2013).

The processes described previously for the thesis diet methods were carried out for each day and every meal. They are pretty simple methods once the food ratios are calculated. The only requirement, aside from the lowest value being selected, was that there had to be at least one entrée and one side for the meal selection to be valid. The only time substitutions were made was to satisfy the meal calorie requirement. Table 10

shows one such situation that happened for lunch on Day 1 for the thesis RD selection method. In this case, the first nine items were originally selected (see the left two columns) but the calories were well above the 980 middle of the road target for the male sailor. Therefore, the white beans in tomato sauce were skipped over, bringing the meal closer to the goal with 1014 calories. Since one of the assumptions made for this thesis was that a serving would be consumed whole, there was not a choice in this sterile selection process to only eat part of the serving. So, if required, selections like in table 10 would be made, this happened for 23 out of the 75 meals selected over the three days analyzed. The “GGG Class” in the table 10 stands for the Galley Go Green classification for the food item, both as type and whether it is a green, yellow, or red food item. Green items are consider a healthier choice by the program than yellow and yellow healthier than red.

Now, looking back over table 7 and 9, it is clear how well both thesis selection methods faired against the Galley Go Green selection with the data that was available for comparison. Both the RD and the Ranked versions showed dramatically lower sodium intakes but with a slight decrease in potassium intakes versus the Green diet choice. However, if one compares the Green 1 to the Ranked selection method the sodium to potassium ratio decreased by 16.2 percent for the male sailor and 4.6 percent for the female sailor. Even larger reductions are seen for the other two ratios. Again, a comparison between Green 1 and the Ranked selection method presents reductions of 34.3 percent for the omega-6 to 3 ratio and 40.8 percent for the sugar ratio for the male sailor and 39.6 percent and 57.8 percent, respectively, for the female sailor. The difference in the percentage changes between the male and female sailor was due to the

fact that the main entrées made up a larger piece of the female sailors diet. Going back to the serving assumption, the female sailor had to consume the entire main entrée, which meant fewer sides than the male sailor. If a female sailor chose the same foods as the male, but just ate proportionally less for each food item the numbers would be the same. Either way, both male and female sailor showed a reduction in the three ratios, but this should not necessarily be a surprise since these were the ratios being targeted.

Table 9. Female Diet Comparison (average per day consumption) Normalized

	Female (19-30)	Green 1	Green 2	Thesis (RD)	Thesis (Ranked)
Calories (NOFFS)	2150	2150	2150	2150	2150
Protein (g) RDA	46	146.1	147.5	122.3	147.0
Carb (g)	130	294.0	297.8	312.2	218.8
Total fiber (g) IOM	28	36.5	37.1	35.7	30.7
Total fat (g)		50.7	48.3	51.8	80.2
Saturated fat (g)		14.3	14.4	16.1	22.1
Cholesterol (mg)	<300	350.7	334.1	210.9	327.5
Calcium (mg)	1000	1548.8	1469.0	1776.4	1110.6
Iron (mg)	18	59.8	58.5	35.8	30.0
Potassium (mg)	4700	5687.4	5617.8	5398.0	5323.1
Sodium (mg)	<2300	4385.6	4465.9	4093.0	3876.3
Vitamin A (mcg RAE)	700	34804.3	34691.6	14021.9	16514.5
Vitamin C (mg)	75	144.6	141.0	125.9	155.3
Protein (%)	10-35	27.19%	27.45%	22.75%	27.35%
Carbohydrate (%)	45-65	54.70%	55.40%	58.08%	40.71%
Total Fat (%)	20-35	21.21%	20.22%	21.70%	33.58%
Saturated fat (%)	<10%	5.97%	6.03%	6.73%	9.24%
Omega 6:3 ratio		7.108	8.889	2.894	4.293
Sugar:NC ratio		0.478	0.480	0.442	0.202
Na:K ratio		0.782	0.813	0.817	0.746

Source: Created by author with data generated using Nutrition Data, http://nutrition data.self.com (accessed October 20, 2013).

The bigger surprise is that the thesis selection methods are pretty much in line with the recommended daily allowance in all the other nutrients. The Ranked version is a little higher in cholesterol than the recommended 300 milligram level, but still lower than the Green diet. Also, the sodium for both Ranked and RD versions are higher than

recommended but again they are lower than the Green diet. All the other vitamins and minerals are above the recommended levels, though some are lower than the Green diet. Finally, the thesis selection methods both have higher saturated fat content than the Green diet but still below the 10 percent maximum level recommended by the USDA. Overall, both of these methods have accomplished the goals set out at the beginning of this thesis.

Table 10. Evolution of Food Selection for Day 1 Lunch Thesis (RD) Male Sailor

Original Choice	GGG Class	Calories		Final Choice	GGG Class	Calories
Veg Beef-Barley Soup	Entrée	79.6		Veg Beef-Barley Soup	Entrée	79.6
French Fried Potato	Sides	208		French Fried Potato	Sides	208
Milk, Skim	Beverage	101		Milk, Skim	Beverage	101
Green Beans, can	Sides	26.9		Green Beans, can	Sides	26.9
Crab Stuffed Fish	Entrée	341		Crab Stuffed Fish	Entrée	341
Mixed Veg	Sides	77.4		Mixed Veg	Sides	77.4
Side Salad (kb,c,lt,sp,m,t,o)	Sides	31.2		Italian Dressing (1 tbs)	Sides	11.2
Italian Dressing (1 tbs)	Sides	11.2		Side Salad (kb,c,lt,sp,m,t,o)	Sides	31.2
Beans, White in Tomato Sauce	Sides	208		Steamed Rice	Sides	138
Steamed Rice	Sides	138				
Total Calories		1222.3				1014.3

Source: Created by author with data generated using Nutrition Data, http://nutrition data.self.com (accessed October 20, 2013).

The U.S. Navy promotes the Galley Go Green program as an effective program to help sailors select healthy foods while eating on shore based galleys. In some ways it does do that, as can be seen in the Red diet results, which show numbers that are dramatically unhealthier than all other methods studied. However, the program does appear to need some improvements. In an environment, such as underway on an aircraft carrier, where a good majority of the food is prepackaged and made to last for long periods of underway time, a more calculated focus on fat, sugar, and sodium should be employed. By taking into account ratios that can offset some affects of high omega-6, added sugar and fructose, and sodium consumption a better diet can be created. A diet

that, from this analysis, is still as healthy in other vitamins, minerals, and macronutrient levels as the Galley Go Green program, but counteracts some negative affects of cafeteria-like food.

Food Selection Method in Action

Between the two methods developed by this thesis, the Ranked selection method is more preferred and will be illustrated for this section due to its more evenly weighted consideration of each of the three ratios. The RD method does demonstrate, by how dramatically it reduced the omega-6 to 3 ratio (52.9 percent for male and 59.3 percent for female compared to Green 1) the potential for a personalized type of selection method. For instance, if someone was most concerned with sodium affects, then that person could give more value to the sodium to potassium ratio. The possibilities are intriguing. However, this section of the chapter is intended to show the food selections for Day 1 between the Green 1 diet and the Ranked diet. The side-by-side comparison will show the differences in food item selection accompanied with a short explanation of why the selections were made in such a manner. This will provide a better understanding of both diets.

Table 11 displays the meal selection results for the male sailor during Day 1. The male sailor choices were used for this section because the larger caloric requirement resulted in more food items being selected. The female sailor's choices were very similar to the male, but with a side item or two less per meal due to a lower caloric need. The chart shows the choices made for each meal for Day 1, also included is the Galley Go Green color classification, calories, and the three ratios for each of the food items. The total line after each meal is the resultant value of all the food items combined per meal.

The calorie total is the sum of the calorie of each item selected for the individual meal. The ratio totals are a little different due to their nature as fractions, so these totals take into account the caloric percentage of the entire meal each individual menu items accounts for. If the reader takes a look back at table 3, then the menu items not selected can be identified. The unselected items will begin the first discussion between the two methods.

Table 11. Green 1 versus Ranked (Day 1 Food Choice Comparison)

Green 1 (male)		Calories	Omega 6:3	Sugar:NC	Ratio Na:K
Breakfast					
Oatmeal	Entrée	104	30.85	0.02	1.59
Egg, Scram (in bag)	Entrée	69	13.50	1.00	1.10
Egg, Scram (in bag)	Entrée	69	13.50	1.00	1.10
Egg, Scram (in bag)	Entrée	69	13.50	1.00	1.10
Cereal (Cheerios)	Entrée	128	21.16	0.06	1.09
Yogurt, Assorted 6oz	Sides	194	2.44	1.00	0.30
Salsa	Sides	10.1	99.00	0.00	1.59
Milk, Skim	Beverage	101	2.00	0.88	0.32
Fruit Salad (cup in water)	Sides	73.5	8.27	0.60	0.04
Total		**817.6**	**14.66**	**0.60**	**0.63**
Lunch					
Veg Beef-Barley Soup	Entrée	79.6	0.00	0.17	1.13
Milk, Skim	Beverage	101	2.00	0.88	0.32
Crab Stuffed Fish	Entrée	341	1.39	0.07	1.90
Italian Dressing (1 tbs)	Sides	11.2	3.66	1.00	16.02
Side Salad (kb,c,lt,sp,m,t,o)	Sides	31.2	2.83	0.55	0.33
Mixed Veg	Sides	77.4	2.74	0.35	0.43
Fruit Salad (cup in water)	Sides	73.5	8.27	0.60	0.04
Beans, White in Tomato Sauc	Sides	208	3.00	0.39	1.48
Total		**922.9**	**2.05**	**0.40**	**1.10**
Dinner					
Veg Beef-Barley Soup	Entrée	79.6	0.00	0.17	1.13
Mixed Veg	Sides	77.4	2.74	0.35	0.43
Side Salad (kb,c,lt,sp,m,t,o)	Sides	31.2	2.83	0.55	0.33
Beans, White in Tomato Sauc	Sides	208	3.00	0.39	1.48
Italian Dressing (1 tbs)	Sides	11.2	3.66	1.00	16.02
Fruit Salad (cup in water)	Sides	73.5	8.27	0.60	0.04
Barbecued Chicken	Entrée	471	12.72	0.72	1.07
Milk, Skim	Beverage	101	2.00	0.88	0.32
Total		**1052.9**	**9.02**	**0.51**	**0.94**

Ranked (male)		Calories	Omega 6:3	Sugar:NC	Ratio Na:K
Breakfast					
Hash Brown	Entrée	138	9.50	0.06	0.08
Breakfast Rice	Entrée	188	2.75	0.02	2.98
Sausage Links	Entrée	176	6.06	0.00	3.25
Milk, Skim	Beverage	101	2.00	0.88	0.32
Bran Muffins	Sides	207	8.00	0.19	0.78
Total		**810**	**5.85**	**0.21**	**0.83**
Lunch					
French Fried Potato	Sides	208	2.74	0.01	0.12
Veg Beef-Barley Sou	Entrée	79.6	0.00	0.17	1.13
Steamed Rice	Sides	138	4.92	0.00	0.62
Fried Chicken (oven)	Entrée	472	12.98	0.00	0.29
Mixed Veg	Sides	77.4	2.74	0.35	0.43
Total		**975**	**6.18**	**0.08**	**0.56**
Dinner					
French Fried Potato	Sides	208	2.74	0.01	0.12
Veg Beef-Barley Sou	Entrée	79.6	0.00	0.17	1.13
Steamed Rice	Sides	138	4.92	0.00	0.62
Fried Chicken (oven)	Entrée	472	12.98	0.00	0.29
Mixed Veg	Sides	77.4	2.74	0.35	0.43
Total		**975**	**6.18**	**0.08**	**0.56**

Source: Created by author with data generated using Nutrition Data, http://nutrition data.self.com (accessed October 20, 2013).

The most blatant similarity between the two methods is the omission of desserts. This similarity seems pretty obvious, however, the reasons for their omission is a bit different. For the Green 1 diet, the Galley Go Green principles classify high calorie, fat,

and sodium foods as the most unhealthy and in the case of a brownie or blueberry crisp that is most definitely true. The Ranked diet, on the other hand, also ranks those as unhealthy, but that is more due to the type of fat and added sugar in those foods. Most prepackaged baked good desserts will be cooked with a vegetable or corn oil, which in the case of the brownie means about a 7 to 1 ratio and for the blueberry crisp about a 14 to 1 ratio of omega-6 to omega-3 fatty acids. And then add on top of that the amount of sugar that is used for those to desserts. So, though they both did not select any dessert as a food of choice, the way they determined that was quite different. It is that different classification method which resulted in the disagreement in the food items they did and did not choose.

At first glance the menu items that the Ranked selection method picked for lunch and dinner seem quite striking. And it is probably the "fried" items that stand out the most. However, this makes sense when remembering that menu items were ranked against the available food items for each meal. With that being said the discussion will begin with the fried chicken choice. To do that it will help to look at the main entrée menu items that were different for lunch and dinner. Both methods selected the vegetable beef and barley soup, but it is the second entrées that disagree. For the Green 1 method, the lunch selection was crab stuffed fish and the dinner selection was barbeque chicken. Both of these food items are rated as "yellow" under the Galley Go Green system, but with no other "green" entrée available it was the next highest entrée. Still, can the fried chicken really be a healthier option than crab stuffed fish or barbeque chicken? The answer in this case is, yes, and the difference came down to sodium levels. The fried chicken, as calculated through Nutrition Data, has 162 milligrams per serving. On the

other hand, the crab stuffed fish was calculated to have 1046 milligrams and the barbeque chicken has 460 milligrams. It was those higher levels of sodium that tipped the scale to the oven fried chicken based on the data used. Table 12 shows the first nine items as they were ranked for lunch, in order to show how close it was between the fried chicken and crab stuffed fish. Once the fried chicken was selected as the main entrée, the sides were selected to fill out the remaining calorie requirement for the lunch meal. But what about the french fried potato?

Table 12. Ranked Food Items (Day 1-Lunch)

Food Item		**Ranked Score**	**Calories**
French Fried Potato	Sides	11	208
Veg Beef-Barley Soup	Entrée	19	79.6
Steamed Rice	Sides	21	138
Fried Chicken	Entrée	21	472
Crab Stuffed Fish	Entrée	24	341
Mixed Veg	Sides	26	77.4
Milk, Skim	Beverage	29	101
Side Salad (kb,c,lt,sp,m,t,o)	Sides	30	31.2

Source: Created by author with data generated using Nutrition Data, http://nutrition data.self.com (accessed October 20, 2013).

For the french fried potatoes, the story is somewhat the same. In the underway galley environment, if oven prepared in the way prescribed by the Armed Forces Recipe Service, this side can be part of an optimal meal for two big reasons. Though about 38 percent of its calories come from fat, it is a valuable side because most of its carbohydrates are starch, helping to bring the fructose to glucose ratio to healthier levels, and has a good sodium to potassium ratio. The amount of sodium in one serving is 61 milligrams (canned mixed vegetables has 111 milligrams) and the potassium amount

makes up 14 percent of the recommended daily value. Those characteristics are important and beneficial when compared to other food item choices. Though it seems somewhat unbelievable with the word “fried” in front, in the environment of an underway ship where high sodium and added sugar intakes are more likely, foods served on aircraft carriers labeled as fried chicken and french fried potatoes can be part of the variety of a healthier diet creation.

This section gave a brief demonstration of how foods were selected for Day 1 using the Ranked and Green 1 methods. It also discussed the importance of the selections made through the Ranked method when considering the environment of underway living and food items available. It is this discussion that cements the thesis’s conclusion that the rules to generating an optimal meal need to be adjusted according to the situation given. The current situation involved sailors underway onboard an U.S. Navy aircraft carrier being served the 21-day menu cycle approved in April 2013. In this situation, a system basing its food selection using three ratios has shown to be an effective method.

Making the Method Usable

How can a method like this be implemented so a sailor standing in the food line can easily make choices with these ratios in mind? It is the opinion of this thesis that the Galley Go Green program should first update its classification criteria to reflect the unbalanced nutrients discussed here: the ratio of omega-6 to omega-3 fatty acids, the ratio of sodium to potassium, and the ratio of sugar to net carbohydrates. With the criteria updated, a Galley Go Green version 2.0 could better classify foods that would benefit sailors in the underway environment. Also, the program could go one step further and incorporate a numerical score for the three ratios used in this thesis on the colored

placards. The simple premise of the Galley Go Green program makes it a valuable tool for sailors and adding numerical scores for the ratios could increase its usefulness. This way even if a food is “green,” some sailors might not like that item or choose something else, so the numerical scores could give an indication of how to choose a similar quality food or correct an unbalance if a lower quality food is picked. The placard could look something like table 13. It still has the basic look of the current placards but now the addition of ratio scores that are either positive or negative with zero being the goal ratio. The more positive the ratio score is the healthier that food is in that ratio. This simple addition adds another depth of value to the current placards.

In the examples provided in table 13, the three ratio scores added to the placards are generated to illustrate the impact each food item has on the specific ratio. The scores take the calculated ratios and turn them into numbers that show the food item’s relative impact on the whole diet. Therefore, if one food item consumed is extremely negative in one ratio, then the sailor knows he or she should be trying to consume highly positive foods in that category for the other meals in order to compensate. The ratio values used as the goal values in these examples were 4 for the omega-6 to 3 ratio, .4 for the sugar to net carbohydrate ratio, and .49 for the sodium to potassium ratio. These goal ratios were loosely generated from evidence gathered during research, but are not proven to be ideal and only used to facilitate the example. Further research would be required to determine the ideal ratios and ranges for the scores to cover. The thesis’s determination has been that a reduction of the ratios is important, but no specific healthy ranges have been proven.

Table 13. Proposed Updated Galley Go Green Example Placards

French Fried Potatoes (oven)						
Calories	**Carbs**	**Protein**	**Fat**	**Chol**	**Sodium**	**Calcium**
208	32	3.4	9	0	61	18
	6:3 Score		**Sgr:NC Score**		**Na:K Score**	
	0.4		1.2		0.2	

Barbecued Chicken						
Calories	**Carbs**	**Protein**	**Fat**	**Chol**	**Sodium**	**Calcium**
471	10.3	44	27	153	460	28
	6:3 Score		**Sgr:NC Score**		**Na:K Score**	
	-8.8		-0.3		-2.4	

Source: Created by author with data generated using Nutrition Data, http://nutrition data.self.com (accessed October 20, 2013).
Note: The "6:3," "Sgr:NC," and "Na:K" scores are based on the calculated ratios (omega-6 to 3, sugar to net carbohydrates, sodium to potassium, respectively) for the two example food items. In this proposed placard, zero means the ratio is meeting the standard, or acceptable, level in this scoring system. The more positive the number is, the healthier that food is in that one ratio. In this example, if a sailor had only these two items for a meal, then their cumulative meal scores per the three nutrient ratio categories would be -8.4 for omega-6 to omega-3, 0.9 for sugar to net carbohydrates, and -2.2 for sodium to potassium. This would tell the sailor they were above standard, or had a healthier ratio, in sugar to net carbohydrates, but below standard in omega-6:3 and sodium to potassium. Therefore, their next food items selected should be positive in these categories in order to get back to or above standard.

An updated Galley Go Green program, in both the way it classifies foods for the underway environment and the addition of ratio scores, could make the thesis's method of selecting food based on three important nutrient ratios usable for the sailor. Therefore, the minimum goal would be to accumulate a net score of zero for each of the three ratios. For those overachieving health conscious sailors, or those more concerned with one category or another, they could strive for higher positive numbers. Consequently, with total calories consumed within the sailor's daily caloric requirement and ratio category

scores greater than or equal to zero, a sailor has very easily constructed, as this thesis has shown, the healthiest diet for the underway environment.

Conclusion

Through the process of this thesis, two different methods were created to classify and pick foods for underway sailors. However, as just discussed, the way the food nutritional information is presented in the galleys on U.S. Navy ships currently, trying to classify in this manner is unrealistic. Of the nutritional data easily accessible to sailors underway, it is only calories, total carbohydrates, and sodium that are provided which are used by the two methods discussed in this chapter. The other data missing for each menu item is omega-6 fatty acids, omega-3 fatty acids, potassium, sugar, and dietary fiber. The missing nutritional information is very important in the way this thesis has classified foods.

Take a look at the result of the Green diet food choices based on the current program. It is clear that sodium is something to be concerned with as it is between two and three times higher than the recommended levels. Therefore, a different strategy needs to be developed to combat or neutralize that issue. In the case of sodium, that can be done in two ways, either reduce sodium intake or increase potassium intake. And if you want to double your chances, you can reduce your sodium while you increase your potassium, thereby lowering your sodium to potassium ratio. This is an important point to consider for a sailor eating food underway on ships. An update to the Galley Go Green program could be one fix, as discussed in the previous section.

The lessons learned, takeaways addressed, and conclusions made are only as good as the information acquired and data collected. Figure 1 shows a graphical representation

of the different diets created and how they measure up to each other in the nutrient categories examined. The two Green diets were averaged together and set as the standard for the other food selection methods for comparison. It is evident that the thesis's selection methods faired well against the Green diets with the data available. Further study in these selection methods, with a broader list of categories not available during the course of this research method, is most definitely welcomed as they are by no means perfect systems. The method of solely using numbers to classify foods has some flaws, as every rule will have an exception. For instance, one conclusion from chapter 2 was the potential dangers of high consumptions of cured and processed meats. However, sausage links were a consistent selection for breakfast for the three days by the Ranked diet method. It is results like this that suggest these methods may be most valuable as an aid and not necessarily the sole answer.

The question that began this quest was this, what food choices should a 23 to 25 year old sailor make to ensure maximum health benefits from his or her meals underway onboard a U.S. Navy aircraft carrier? The answer turns out, for the 21-day menu cycle used and the data available, to start with three simple numbers: the ratio of omega-6 to omega-3 fatty acids, the ratio of sodium to potassium, and the ratio of sugar to net carbohydrates. The lowest values of these three ratios produced two food selection methods to create diets, which were comparable, and in some cases healthier than the diets of the Galley Go Green program the U.S. Navy promotes in its shore-based galleys. Using those three ratios can guide a sailor to choose foods that produce a better overall diet, even if sometimes it selects sausage links for breakfast, by focusing on extremely out of balanced nutrients from the food served. And if these ratios are used by an

intelligent sailor who decides to skip the processed meat some mornings, then the resultant diet might be even more effective.

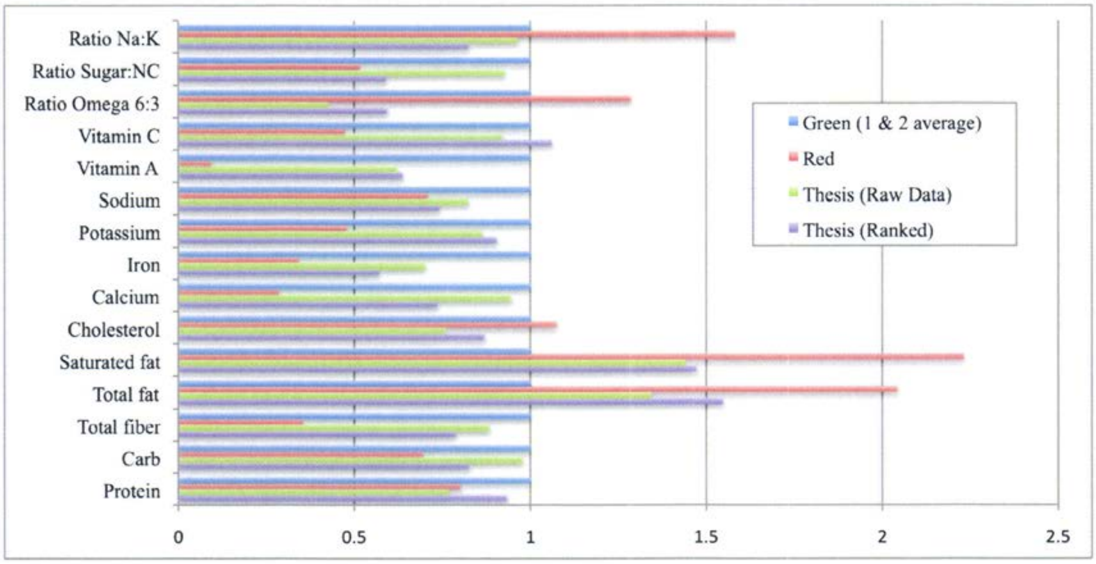

Figure 1. Diet Comparison for Male Sailor Relative to Galley Go Green Food Choice

Source: Created by author with data generated using Nutrition Data, http://nutrition data.self.com (accessed October 20, 2013).
Note: Green diet is the average of the Green option 1 and Green option 2 diets, which was set to one as the standard diet for individual nutrient comparison.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

The purpose of this paper was to gain a deeper understanding of nutrition, its affect on human health, and how that could be tailored into food choices made by sailors underway on a United States Navy vessel. The culture of the U.S. Navy appears to have increased the value of fitness and overall health in recent years. Many reasons could be given for this shift, but a main contributor, identified earlier in this thesis, was the announcement of the 21st Century Sailor and Marine Initiative in 2012 by the Secretary of Navy Ray Mabus. This initiative is aimed at emphasizing the important task for the Department of Navy to grow and strengthen its people in all aspects of life. Nutrition, a subset of the fitness pillar for the initiative, is mentioned as an important part of the overall wellness of an individual. It is this reason that calls for the U.S. Navy to provide the best environment for sailors and marines to make informed and healthy nutritional choices.

This paper looked directly at the nutritional environment that has been created since the inception of the 21st Century Sailor and Marine Initiative. The research started with U.S. Navy educational programs, guidelines, and resources before focusing directly of food and nutritional choices. With a greater understanding of the current status and nutritional culture of the U.S. Navy, research switched to scientifically supported themes of nutrition, diet, and health. This phase of research had the specific task of learning about the cause and effect of food choices on one’s health, in order to address a decision that sailors have to make three times a day. What food choices should he or she make to ensure maximum health benefits from his or her meals?

The answer to the primary research question came down to focusing on the most current nutritional recommendations, backed by clinical trials and research, and on a specific menu cycle, the 21-day menu cycle for deployed aircraft carriers. This combined focus created customized strategies to counter an environment that forces foods to last for extended periods between replenishments and requires meals for a upwards of 6000 crewmembers per day to be prepared quickly and efficiently. The dependency on prepackaged and certain processed foods is understandable. However, it means the rules of food choices should be adjusted. The strategies analyzed in this thesis focused on foods that minimized the ratios of omega-3 to omega-6 fatty acids, sodium to potassium, and sugar to net carbohydrates. These ratios directed attention on characteristics consistent with processed and prepackaged foods, which include high amounts of omega-6 fatty acids, sodium, and added sugar.

It is the opinion of this thesis, through the research and analysis conducted with the data available for the 21-day menu cycle, that the ratio of omega-6 to omega-3 fatty acids, the ratio of sodium to potassium, and the ratio of sugar to net carbohydrates can be used to choose foods that yield the healthiest diet in the underway aircraft carrier environment. Therefore, it is with that conclusion that the following recommendations are made.

Recommendations

The U.S. Navy has made many positive strides towards promoting a healthy nutritional minded organization. However, many of the programs, educational tools, and publications seem to skip over the specific challenges of food choice in an underway deployment. For instance, the only mention of deployment nutrition in the U.S. Navy's

Nutritional Guide 2011 discusses the 80/20 rule, meaning eat healthy 80 percent of the time and favorite foods the other 20 percent of the time (Navy Personnel Command 2011, 12). Though this guide is only 17 pages long, this could be a prime location to address some potential diet concerns for an underway type of environment. Even the NOFFS, seemly championed every time nutrition is mentioned on a U.S. Navy website or publication, promotes a diet of six small meals throughout the day. This may work in most situations at home, but underway, when the primary source of food is a galley that serves three meals per sailor, it does not. Therefore, these are recommendations for the U.S. Navy concerning nutritional resources and practices for underway deployments:

1. A nutritional guide of what foods to expect while underway. Even if a sailor is eating in shore-based galleys in port, they always have the opportunity to supplement their foods somewhere else. However, a discussion should be had on any unique qualities of deployment foods and menus.
2. Many sailors track the foods they eat while at home and with the prevalence of smartphones many nutrition-tracking services are available in the palm of a person’s hand. The NOFFS program has a wonderful phone application that includes a meal building functionality. This function, same as the virtual meal builder used for calorie consideration in chapter 4, recommends servings per food type (grains, protein, fruits, vegetables, and fats) and calories needed. An expansion of this meal builder could be very powerful and useful for underway sailors by incorporating menu cycle items for nutrition-tracking. If not an expansion of the current application, a standalone application, even an intranet site on the ship’s computer network system, could be just as beneficial. This

way, if the meals were posted daily and easily accessible, a sailor could better plan meals in advance or while waiting in line.

3. Somewhat along the same lines as a nutrition-tracking service, the U.S. Navy, with cooperation with the Armed Forces Recipe Service, should expand the amount of nutritional information that is easily accessible to sailors on the food being served underway. Not every sailor is going to look up the nutritional information of the food they are eating, however, there are many that will. And this thesis has demonstrated, in the three days analyzed, that the current data is not sufficient in aiding a sailor trying to make healthy food decisions. Even McDonald’s Corporation reports 14 unique nutritional fields (McDonald's Corporation 2013, 1), while Department of Defense menu items only report seven. If sailors are going to be able to replicate food choices as outline in this paper, then the additions need to include polyunsaturated fats, with omega-6 and omega-3 fatty acids broken out, potassium, sugar, and fiber.
4. The final recommendation is to employ an upgraded version of the Galley Go Green program on all U.S. Navy ships. The Galley Go Green program is a good program with a simple concept to give sailors an idea at a glance what might be a good choice. However, as shown through the course of chapter 4’s analysis, a 2.0 version might be beneficial. If utilizing the Galley Go Green principles, as done for the days used for this paper, results in a diet that exceeds the upper limit of sodium and cholesterol recommendations by the *Dietary Guidelines for Americans, 2010,* then a tweak needs to be made. The proposal made in this thesis is to first update the food classification criteria to put more

emphasis on the three ratios studied: omega-6 to omega-3, sodium to potassium, and sugar to net carbohydrates. Furthermore, to create a scoring system for these ratios and display them along side the currently used color placards in the program. Research will be required to determine an acceptable range fore these ratios, however, the payoff could be huge in the health of U.S. Navy sailors. See table 13 for a proposed example.

These recommendations come down to one main theme, the deployment. During the course of research, there was not much discussion found on underway-specific nutrition. I think this should be the next step for the U.S. Navy as it continues to expand on creating a culture of fitness.

Conclusion

One consistent responsibility of the United States Navy as a global force is being deployed underway on ships across the world. This means it is as important to encourage healthy nutritional practices at sea as it is in port. The U.S. Navy continues to improve its nutritional education across the fleet and with the types and varieties of food served to its sailors at home or away. However, it is this thesis's opinion that the next place the U.S. Navy should focus for improvement in the food and nutrition realm is in underway specific nutritional education programs. The environment and food choices on ships are more restrictive than they are at home on land, and therefore, nutritional education underway cannot just be an extension of shore-based guidelines. It has been found through the course of this project that it needs to be addressed separately.

The truth about food and nutrition is that we are what we eat. That fact is immensely important and clear. Our digestive system breaks down the food we ingest

into usable material to repair, build, and maintain our bodies. It is no surprise that many chronic diseases show direct correlations with the quality of food eaten. With the amount of time that many sailors spend at sea through the course of their career, they are owed specific information and considerations for nutrition underway. A healthy and effective investment in underway food education can truly help the individual sailor and the United States Navy as a whole.

APPENDIX A

TABLES OF MENU ITEMS

Table 14. Day 1 Menu

Breakfast	**Lunch**	**Dinner**
Muffins	Banana Cake	Banana Cake
Breakfast Burrito	Beans, White in Tomato Sauce	Barbecued Chicken
Breakfast Rice	Blueberry Crisp	Beans, White in Tomato Sauce
Cereal (cheerios)	Brownies	Blueberry Crisp
Creamed Beef	Cheese Burger	Braised Beef and Noodles Soup
Egg, Hard	Chili Conqui	Brownies
Egg, Scram (in bag)	Corn Bread	Cheese Burger
English HEC	Crab Stuffed Fish	French Fried Potato
English SEC	French Fried Potato	Fried Chicken
French Toast	Fried Chicken	Gelatin
Grilled Ham, Canned	Gelatin	Green Beans, can
Grits	Green Beans, can	Mac and Cheese
Hash Brown	Mac and Cheese	Mixed Veg
Maple Syrup	Mixed Veg	Onion Soup
Oatmeal	Onion Soup	Pudding 4oz
Oven Fried Bacon	Pudding 4oz	Steamed Rice
Pancakes, Buttermilk	Steamed Rice	Veg Beef-Barley Soup
Salsa	Veg Beef-Barley Soup	
Sausage Gravy w Biscuit		
Sausage Links		
Sausage Patties		
Sweet Dough		
Waffles		
Whole Wheat Rolls		
Yogurt, Assorted 6oz		

Source: Food Service Management (FSM), “FSM AIRFOR April 13 Menus,” https://fsm.navsup.navy.mil/fsm/mainmenu.aspx (accessed June 12, 2013).

Table 15. Day 14 Menu

Breakfast	Lunch	Dinner
Banana Nut Muffins	Baked Sweet Potato	Baked Potato
Blueberry Muffins	BBQ Beef Sandwich (sloppy)	Baked Potato Bar
Bran Muffins	Beans, White in Tomato Sauce	BBQ Beef Sandwich (sloppy)
Breakfast Burrito	Calico Corn	Beans, White in Tomato Sauce
Breakfast Rice	Cheese Cake	Brown Gravy, Instant Dry
Cereal (Cheerios)	Chocolate Chip Cookies, Fzn	Calico Corn
Egg, Hard	Chocolate Mousse	Cheese Cake
Egg, Scram (in bag)	Coleslaw (prepared dressing)	Chocolate Chip Cookies, Fzn
English HEC	Cream Chicken Mushroom So	Chocolate Mousse
English SEC	Fruit Salad (cup in water)	Coleslaw (prepared dressing)
French Toast	Garlic Rst Steak Fry Wedge Fz	Cream Chicken Mushroom So
Fruit Salad (cup in water)	Gelatin	Fruit Salad (cup in water)
Grilled Ham, Canned	Green Beans, can	Garlic Rst Steak Fry Wedge Fz
Grilled Steak	Grilled Fish Salmon	Gelatin
Grits	Ice Cream Bar w fudge, cone	Green Beans, can
Hash Brown	Italian Dressing (1 tbs)	Horseradish Sauce
Maple Syrup	Milk, Skim	Ice Cream Bar w fudge, cone
Milk, Skim	Old Fashion Bean Soup	Italian Dressing (1 tbs)
Oatmeal	Onion Rings Breaded	Milk, Skim
Oven Fried Bacon	Oriental Vegetable Stir Fry	Old Fashion Bean Soup
Pancakes, Buttermilk	Roast Turkey Sandwich	Onion Rings Breaded
Salsa	Roasted Pepper Potatoes (Inst)	Oriental Vegetable Stir Fry
Sausage Gravy w Biscuit	Side Salad (kb,c,lt,sp,m,t,o)	Roast Rib of Beef (Ribeye)
Sausage Links	Steamed Brown Rice	Roast Turkey Sandwich
Sausage Patties	Strawberry Shortcake	Roasted Pepper Potatoes (Inst)
Sweet Dough	Sweet Potato Bar	Seafood Newburg
Waffles	Tarter Sauce	Side Salad (kb,c,lt,sp,m,t,o)
Whole Wheat Rolls	Teriyaki Chicken	Steamed Brown Rice
Yogurt, Assorted 6oz	Whipped Topping	Strawberry Shortcake
	Yogurt, Assorted 6oz	Whipped Topping
		Yogurt, Assorted 6oz

Source: Food Service Management (FSM), "FSM AIRFOR April 13 Menus," https://fsm.navsup.navy.mil/fsm/mainmenu.aspx (accessed June 12, 2013).

Table 16. Day 18 Menu

Breakfast	Lunch	Dinner
Breakfast Rice	Refried Beans Dehydrated Mix	Refried Beans Dehydrated Mix
Sausage Links	Scandinavian Veg Blend	Roast Turkey (Boneless)
Hash Brown	Parsley Buttered Potatoes	Herbed Broccoli
Grilled Canadian Bacon	Herbed Broccoli	Scandinavian Veg Blend
Milk, Skim	Collard Mushroom & Barley Sou	Mashed Potatoes (Inst)
Yogurt, Assorted 6oz	Milk, Skim	Milk, Skim
Bran Muffins	Side Salad (kb,c,lt,sp,m,t,o)	Side Salad (kb,c,lt,sp,m,t,o)
Fruit Salad (cup in water)	Yogurt, Assorted 6oz	Collard Mushroom & Barley So
Salsa	Chili Con Carne	Yogurt, Assorted 6oz
Grits	Tacos (Beef-Precooked)	Shrimp Gumbo
English SEC	Shrimp Gumbo	Ice Cream Bar w fudge, cone
Cereal (Cheerios)	Rice Pilaf	Chili Con Carne
English HEC	Fruit Salad (cup in water)	Rice Pilaf
Oatmeal	Italian Vegetable Medley	Tacos (Beef-Precooked)
Waffles	Beans, White in Tomato Sauce	Fruit Salad (cup in water)
Oven Fried Bacon	Hot Italian Sandwich	BBQ Beef Sandwich (sloppy)
Blueberry Muffins	Onion Rings Breaded	Beans, White in Tomato Sauce
French Toast	Chicken Cacciatore	Italian Vegetable Medley
Egg, Hard	Ginger Molasses Cookies	Hot Italian Sandwich
Whole Wheat Rolls	Sausage Variety Sandwich (Brat)	Onion Rings Breaded
Egg, Scram (in bag)	Taco Condiment Bar	Gelatin
Banana Nut Muffins	Chili Condiment Bar	Chili Condiment Bar
Breakfast Burrito	Gelatin	Sausage Variety Sandwich (Brat
Sweet Dough	Spaghetti w Meat Sauce	Taco Condiment Bar
Pancakes, Buttermilk	Chocolate Cream Pudding	Ginger Molasses Cookies
Sausage Patties	Pudding 4oz	Pudding 4oz
Sausage Gravy w Biscuit	Apple Crunch	Italian Dressing (1 tbs)
Grilled Ham, Canned	Italian Dressing (1 tbs)	Brown Gravy, Instant Dry
	Spareribs and Sauerkraut	Apple Crunch

Source: Food Service Management (FSM), "FSM AIRFOR April 13 Menus," https://fsm.navsup.navy.mil/fsm/mainmenu.aspx (accessed June 12, 2013).

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